THE FOUNDRY

for July

Leaders Call For Followers

ARE leaders stepping out in the foundry industry? Or is every man a *King?* How can we stimulate business? How cure (not relieve) unemployment? Shall we be satisfied, in today's crisis with futile meetings? Will tiresome discussion of *timely* topics of general interest work a miracle for the foundry industry? Is the answer to be found in the work of secretaries, paid executives and committees, or in leadership?

Meetings of various groups of the foundry industry held in June, evidence the existence of leadership in greater or less degree in gray iron, steel, malleable and nonferrous associations. Those organizations that face business problems will survive. Divested of side issues, the job ahead of each is to help foundrymen to produce and sell castings at a profit. Fringe interests, frills and window dressing fall outside the main issue. They should be forgotten.

THE FOUNDRY is the friend of foundrymen everywhere. You readers know what you want and need and whose leadership you will follow.

Do you accept the large companies in your branch of the industry? Will you follow and work in your trade association? If not, will you tell them or THE FOUNDRY, why? What do you want done in *your* industry?

Generals without armies win battles only in comic opera wars. While no Hitler can behead you if you don't play ball, does your intelligence tell you that you can go along alone? Can you swim while your industry sinks?

Shall we shoot every so-and-so, those price cutters? It's being done in the racket industries, booze, narcotics, many others. If that can't be done in the foundry industry, then what? Do you expect to sit at home and growl? Or will you help your own industry and its trade association with candid, patient effort and suggestion?

If you think such co-operation won't do good, will you let us publish your thoughts, with or without your name? Foundry products serve the world. They make modern comfort, speed, convenience possible. The industry is better equipped in knowledge and skill than any time in history. Is the laborer worthy of his hire? Do you, Mr. Foundryman, want profits, a reward for your effort?

Followers are wanted who can answer, yes, to the following: Will you treat your employes fairly? Will you follow recognized cost practices of your group? Will you refrain from vicious price cutting—and you know what that means? Will you build sound merchandising in your own industry? Will you work with all foundrymen to resist replacement of castings by unqualified competing products? Will you follow your industry's fair trade practices?

THE FOUNDRY counts on the intelligent self interest of enough of you to formulate a program—and follow it. Do your part. Support your industry. Follow the leaders—or tell us, Why!

Uncle Sam Cast as Paul Pry

BUREAUCRATS are curious. They love questionnaires, reports, statistics. The blue eagle era encouraged this hobby in Washington, provided official sanction for plagueing inquiries, swelled ranks of clerks. The collapse of NRA was slightly discouraging, although mail, wire and telephone at once carried urgent queries. Who is breaking the rules? Who is chiseling? Give us reports, names, figures. The aftermath of any labor dispute looses a flood of official forms. One from the bureau of labor statistics with 24 questions and numerous subheads pries into intimate details, which the employer is urged to supply. Farmers, manufacturers, merchants, bankers encounter an ever mounting flood of bureau forms, inquiries, ballots. Bureaucrats are *most* curious.

MELTS IRON IN AIR FURNACES

By PAT DWYER

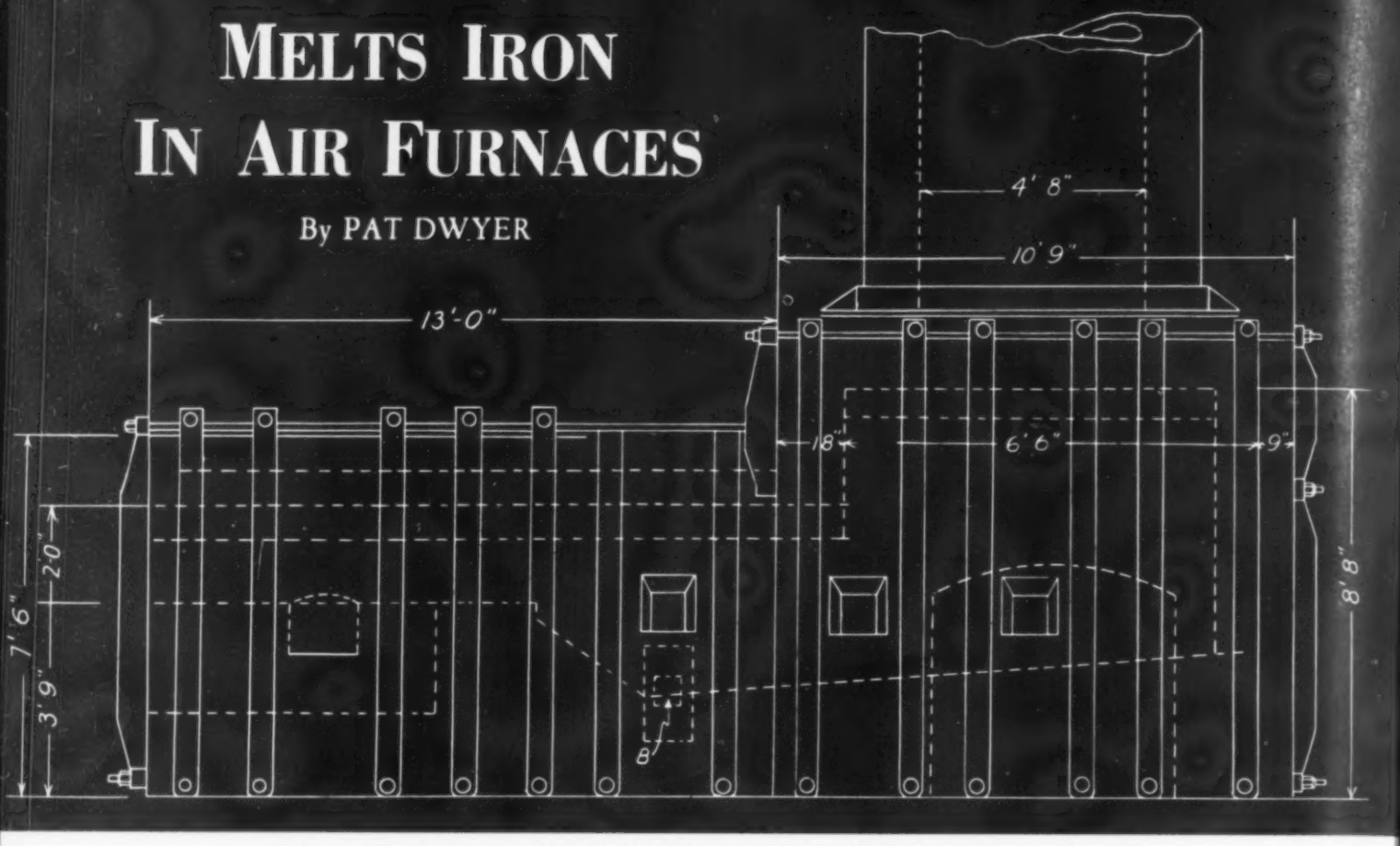


Fig. 1—The furnace is fired at the left and charged through a door at the right

IRON rolls, sand and chilled have been made in this country by the Mackintosh-Hemphill Co., for over 100 years. Steel rolls have been made continuously since 1888. Genesis of the company extends through various company names back to the original Pittsburgh Foundry established by Joseph McClurg in 1803. At present iron rolls and a miscellaneous line of iron castings are produced in the plant formerly known as the Garrison Foundry in Pittsburgh. Steel rolls and other steel castings are made at the company's plant in Midland, Pa. Activities in this plant will be discussed in a later article. The present description is confined to certain features in the Pittsburgh plant.

Certain small hard chilled iron rolls used for special purposes where strength to some extent may be subordinated to extra hardness, are cast from cupola melted metal, but the majority of the rolls are cast from iron melted in a battery of five air furnaces, one with a capacity of 25 tons, one of 10 tons and three with a capacity of 15 tons. These various capacities represent a normal operating load, but on occasion smaller special heats may be melted, while on other occasions it may be necessary to increase the charge in varying amounts from 10 to 30 per cent.

Through extended and long continued use in the Pittsburgh district this partciular type of furnace shown in Fig. 1 has come to be known as the Pittsburgh furnace. Principal dimensions for a furnace with a normal melting capacity of 18 tons are shown in the illustration. For some time one furnace in the battery has been fired with powdered coal through a unit supplied by the Whiting Corp., Harvey, Ill. Although the initial cost of this unit is rather high in comparison with other methods of firing, it is claimed that other advantages offset this particular feature, and that it provides the best flame control, fastest melting, less oxidation, and is the most economical through the use of lower grade coal. The other four furnaces are hand fired

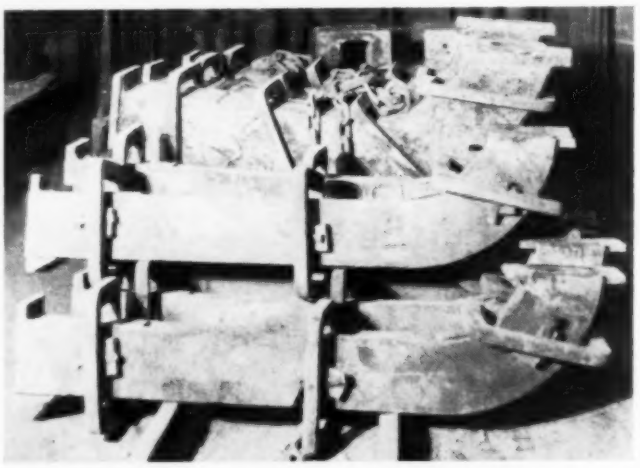


Fig. 2—Roll runners are made in cast iron containers

with a high grade local coal showing 35 per cent volatile and less than 1 per cent sulphur. The average melting ratio is 1 pound coal to 3 pounds iron. Coal is shoveled through the doorway *A* at the left and spread over a wide grate. The fireman has access to the outer end of the grate for manipulation of the fire during the progress of the heat. Constant attention is required to maintain proper melting conditions.

Hot Reducing Flame Maintained

The fire may be lighted with either wood or oil. Thereafter a continuous hot reducing flame is maintained until the metal is tapped. Coal in small amounts is added at short intervals. Between these additions the fire is raked over and the bed of coals is cut with a steel slice bar working through the grate bars to prevent the formation of holes in the fuel bed, which would permit the entrance of excess air and result in an excessive oxidation of the metalloids in the bath. Usually only one heat is melted per day in this type of air furnace.

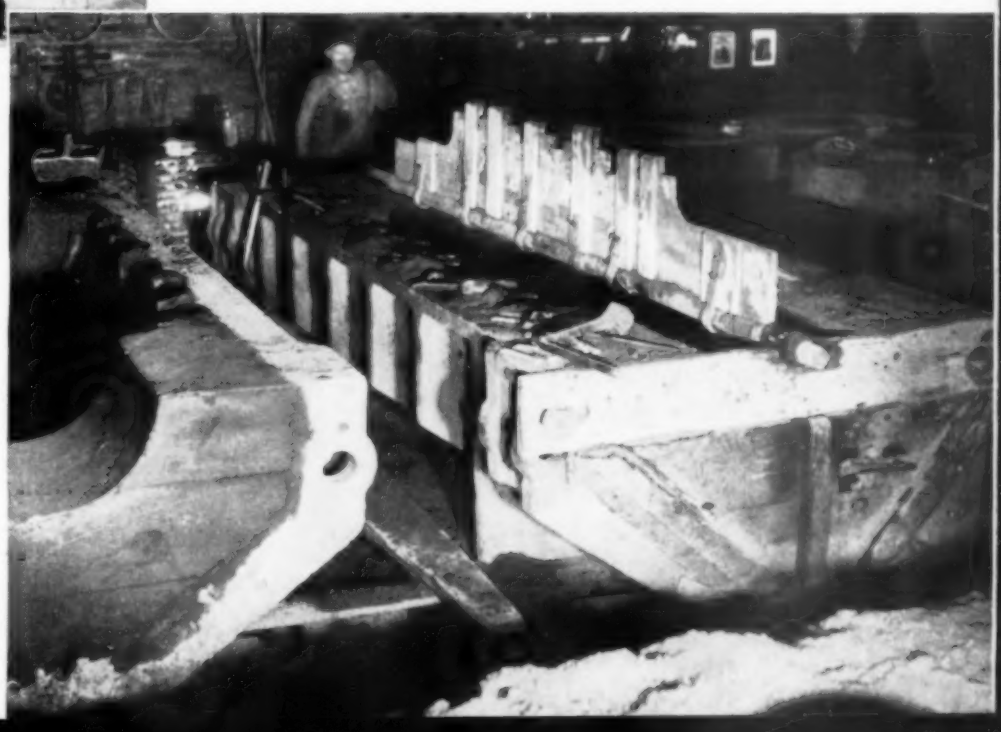
After the furnace has been tapped, a large brick lined door at the opposite or right end of the furnace, Fig. 1, is removed and the furnace is allowed to cool. The bottom is repaired wherever necessary with silica sand and arranged to present a gradual slope toward the tap hole shown at *B*. The sand then is covered with boards to prevent individual pieces in the charge from gouging holes in the bottom.

Material for each charge is selected in the day time and loaded on a platform outside the charging end of the furnace. After the furnace has cooled sufficiently a night gang places the charge on the boards. Large pieces of scrap rolls are moved with pinch bars to a position close to the bridge wall. The pig iron follows and is so arranged that the flame has free access to each piece and also has free passage to the opening in the side wall close to the bottom leading to the stack. The door then is replaced and the joint sealed with clay.

Raw materials include warm blast charcoal iron, worn out rolls and the usual foundry return scrap, heads and gates. The usual ratio for sheet and tin mill hot rolls is 40 per cent pig iron and 60 per cent scrap. Each car of pig iron is inspected carefully, analyzed for chemical and physical properties and stored in a separate pile or bin in the yard spanned by a 5-ton crane. To prevent irregularities possibly present in each car load lot, the pig iron content for each charge contains amounts varying from 5 to 15 per cent from at least four different piles. This method produces a self perpetuating mixture. When pig iron from a new lot must be used, little actual change is made in the total charge.

Only sand cast pig iron is used. Selection further is confined to irons in which the physical properties are normal from normal working blast furnaces. *Off* pig irons never are used. It is an axiom in chill roll manufacture that the physical properties of the raw materials persist through to the finished product. The grades of pig iron also differ. The charge is made up of several lots showing approximately 1.75, 1.25 and 0.50 per cent silicon, respectively. The scrap also is selected carefully both by fracture and chemical analysis. In many instances, of course, the physical properties and chemical analysis of the scrap are known, since the rolls originally

Fig. 3 (Left)—Pattern for neck and wabbler mounted on plate. Fig. 4 (Below)—Molds for grooved rolls are swept horizontally in heavy flasks



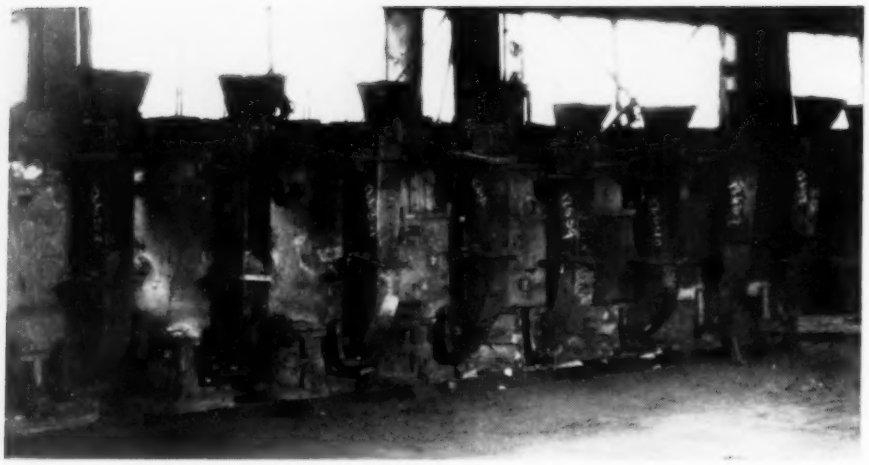


Fig. 5—Small roll molds are set up and poured above the floor level

were made in the plant. Each roll as cast carries an identifying number. This number with accompanying case history is recorded in the office files.

Losses and Gain Calculated

The charge is calculated to the hundredth point decimal and carefully weighed. Usual anticipated melting losses and gain include losses of: Silicon 0.30 per cent, carbon 0.25 per cent, manganese 0.20 per cent; gain sulphur 0.02 per cent and no change in the phosphorus content. Total melting loss including iron averages 5 per cent. The average weight of gates and heads on sheet and tin mill rolls is 15 per cent, showing a yield of 80 per cent castings from the heat. Scrap castings reduces this yield by approximately 5 per cent. With smaller rolls the percentage for heads and gates may rise to 30 per cent.

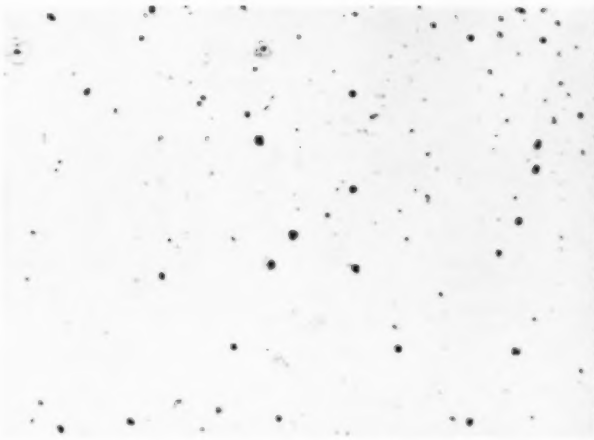
The charge in the furnace usually melts down in about 5 hours. The bath then is stirred vigorously with green wood poles inserted through the doors *C C* Fig. 1. Each pole is about 6 inches in diameter and 12 feet long. The end of the pole is forced to the bottom of the bath thus producing a vigorous action in the bath which also brings up any cold metal on the bottom. Poling is practiced for about 3 minutes after which the bath is moved around by using the pole as an oar.

At this stage the first chill test is taken by withdrawing a few pounds of iron in an iron spoon at the end of a long iron handle inserted through the door *C*. The test mold is made in green sand and is about 1½ inches wide, 4 to 5 inches long and 4 to 5 inches high. The bottom of the test mold is a cast iron block 3 inches thick, 4 inches wide and 6 inches long. If the metal is too hot it is allowed to cool to casting temperature — 2450-2500 degrees Fahr. — before it is poured. The test block is covered with dry sand and allowed to stand for 10 minutes. Then it is taken out of the mold and cooled rapidly by plunging it into cold water several times. Sufficient time is allowed between immersions to permit the test block to become dry.

The test piece then is broken approximately in the center. One part is examined visually by the metallurgist to note the depth of chill. The other part is taken to the laboratory for chemical analysis. Reading and interpreting the depth of chill is one of the most important features in the entire cycle of operation. Also, in common with several other features, it is a form of knowledge which only can be acquired through close application and long practical experience. Although it is a guide, the depth of chill does not always coincide with the depth anticipated from the chemical content. Variations in the quality of the raw materials, melting conditions and furnace operation affect the chill depth. What is still more important, these factors exert a bearing on the relation between the depth of chill in the test piece and the depth which will appear in the roll where the great thickness of metal affects the crystal formation.

Roll foundrymen are divided into two schools on the proper method of reading chill tests. One reads the total depth to the first decided gray iron mottle, divide (*Please turn to page* 44)

Fig. 6—Long curved spouts from adjacent furnaces deliver metal to a ladle pit



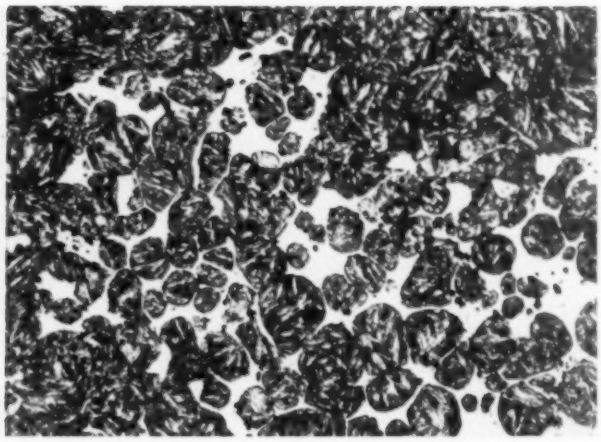


Fig. 47—Gray iron heated to 2000 degrees Fahr. and quenched, x 100, unetched. Note most of the graphite has redissolved. Fig. 48—Gray iron heated to 2000 degrees Fahr. and quenched, x 100, etched. Note the white cementite and a martensitic background

GRAY CAST IRON

By JOHN W. BOLTON

Chapter II (*Concluded*)

AT ORDINARY or room temperatures complete and stable equilibrium of the iron-carbon alloys under consideration is reached only when alloys consist of ferrite—containing traces of carbon—and graphite. The compound cementite (Fe_3C) is meta-stable, that is, stable only under certain restricted conditions. Outside that range it may be broken up, wholly or in part, into its constituents—iron and graphite—at temperatures below the eutectoid transformation or austenite and graphite at temperature above the eutectoid, if conditions allow attainment of total or partial equilibrium. In the presence of considerable silicon cementite not merely is meta-stable, but often apparently unstable. The metastability and unstability of cementite, and particularly of the forms not found in pearlite, makes possible the commerical production of gray irons—irons containing no cementite other than that in the pearlite or eutectoid—and containing much free graphite.

According to the meta-stable iron-carbon diagram, graphite is formed as a decomposition product of solid cementite. That is, austenite and cementite are formed upon solidification. Graphite is precipitated subesquent to the formation of solid cementite.

If the reader is content with an hypothesis which explains most ordinary phenomena in a practically satisfactory manner, he probably will find the meta-stable diagram sufficient. However, a number of investigators believe that it is possible for graphite to separate directly during solidification of the melt. They maintain that if sufficient time is allowed for equilibrium to become established, graphite formation is not necessarily a result of cementite decomposition and that the commonly observed formation of cementite preceding graphitization is due to undercooling. Some hold that cementitic formation may be preceded by graphite formation, and a graphite-austenite eutectic is possible. These possibilities are depicted by so-called double equilibrium diagrams.

Those of Benedict's and of Ruer and Goeren's are shown in Figs. 49 and 50. It has been known for some time that a certain degree of superheating often modifies the degree of graphitization markedly. As shown in Fig. 51, Norbury has constructed a diagram which admits or recognizes four possibilitiesfi namely a normal and a supercooled graphite, a normal austenite cementite eutectic and a supercooled austenite

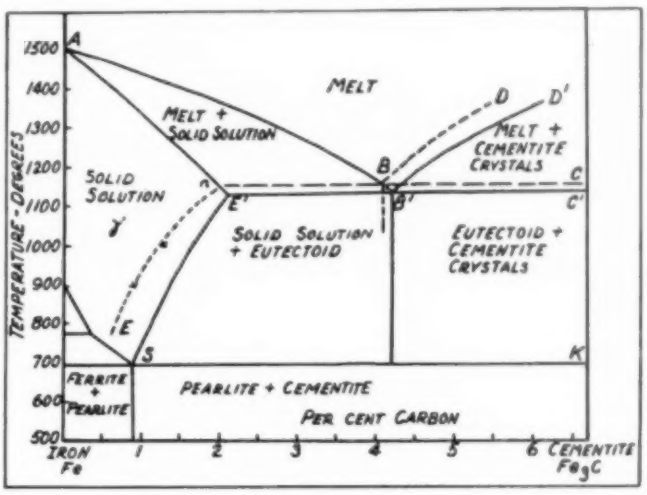


Fig. 49—Double diagram of iron-carbon alloys, according to C. Benedicks

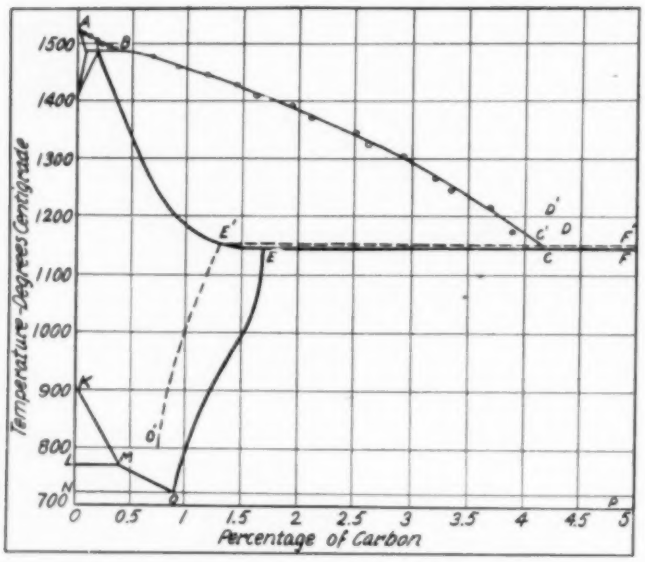


Fig. 50—Double diagram of the iron-carbon alloys, according to Ruer and E. Goerens

cementite eutectic. These diagrams suggest that graphite and cementite differ in their solubilities in austenite, as was originally postulated by H. A. Schwartz—*Transactions* A.I.M.E. Vol. 68, 1923, pages 916-927.

It will be noted that in these diagrams, Figs. 49, 50, and 51, the dotted lines represent the *iron-graphite* or *stable* system; the full lines, the meta-stable system discussed previously.

Unanimity of Opinion Lacking

In spite of the great volume of painstakingly obtained research data which has accumulated, and the careful analyses of the various studies by many eminent investigators, full unanimity of opinion does ot exist today. The reader is referred to the monograph—Alloys of Iron and Carbon to be published late in 1935—for greater details on the subject. The first equilibrium diagrams of Roberts-Austen (1897 and 1899) and the Roozeboom diagram (1900) assume the presence of a graphite iron eutectic and solid solution of iron and carbon immediately below the point of eutectic solidification, hence indicate that the system is austenite-graphite. Later work showed these assumptions at least partially untenable and the existence of the meta-stable system is established. The possibility or probability of direct precipitation of graphite and the validity of the various double iron-carbon diagrams still are unanswered questions.

The leading facts and arguments pro and con may be summarized as follows:

1—It seems probable that carbon in molten iron exists largely in cementitic formation. Cesaro—*Journal* Iron and Steel Institute, 1919, pages 447-457, and Korber and Oelson—*Archiv fur Eisenhuttenwesen*, 1932, pages 569-578—reached that conclusion from thermodynamic considerations.

Also treatments, such as drastic quenching, normally produce a cementite-autenite structure. Graphite as such apparently cannot exist in molten iron under conditions of equilibrium. The molten solution must consist either of carbon largely in atomic dispersion in the iron or largely in the form of a compound or compounds. Such evidence as is available suggests the existence of cementite, although the possibility of some dissociation of such a compound cannot be denied. (It has been claimed by Hanemann and by Piwowarsky that such dissociation begins when the metal is heated above 2730 degrees Fahr.)

Depends on Many Factors

If the dissolved substance is cementite it seems as though on initial solidification that compound first would separate out and that graphite formation would be a secondary reaction. The degree of graphitization would depend on a number of factors, so that the time element could not be predicted readily. For example *seeding* the liquid with graphite, the presence of high carbon content, the presence of silicon, and slow cooling promote graphitization. Superheating within certain temperature and composition ranges, the presence of chromium or high manganese, and rapid cooling tend to inhibit graphitization.

Yet in view of the possibility of change of constitution coincidental with change in state it is not possible to state dogmatically that in undergoing a change in state a change in composition may not occur simultaneously.

2—Ruer and Goerens—*Ferrum*—1916-1917, pages 161-177—found two thermal arrests just below the eutectic temperature in heating curves of a specially prepared *pure* cast iron. From this and other data they concluded that the first arrest corresponded to the melting of the cementite eutectic, and other to the melting of a graphite eutectic. These points were 2094 and 2106 degrees Fahr, respectively. A similar

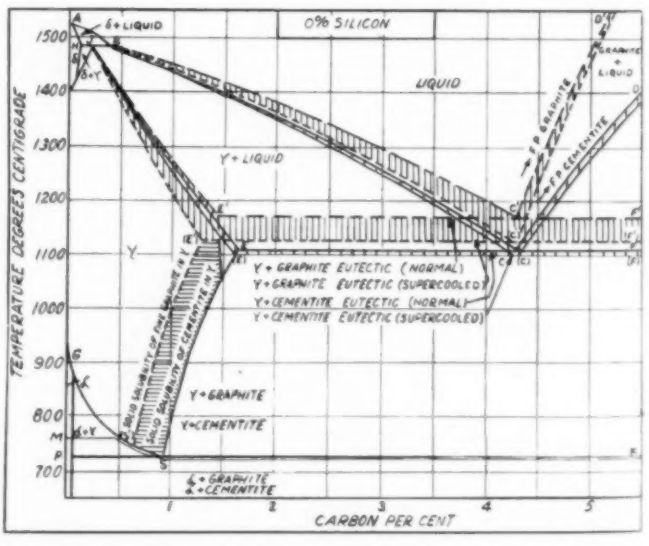


Fig. 51—Constitutional diagram for cast iron containing no silicon, according to Norbury

phenomenon was observed in cooling curves. Honda and Kase—*Science Reports*, Sondai (1st series), 1930, pages 17-35—repeated these tests and were unable to find any two-stepped arrests in the cooling curves, although they found stepped arrests in the heating curves. They explained this latter by the difference in velocity of dissolution of graphite and cementite in iron, and maintain that on extremely slow heating these points would coincide. The final differences they found were only about 4.5 degrees Fahr.

Approaching Eutectic Temperature

A number of investigators, including the author, have heated gray irons up to close to the eutectic temperature, held them there for some time and then quenched. Apparently the nearer the eutectic temperature is approached, the nearer the samples are free from graphite. For example Fig. 47 shows the unetched structure of an iron quenched from 2000 degrees Fahr., Fig 48 is same sample etched. Note that although the original metal was a soft gray iron with many graphite flakes, the quenched sample shows that almost all the graphite is re-dissolved, Fig. 47, and cementite has reappeared, Fig. 48. The white areas are cementite.

Conversely Kase and others have cooled irons

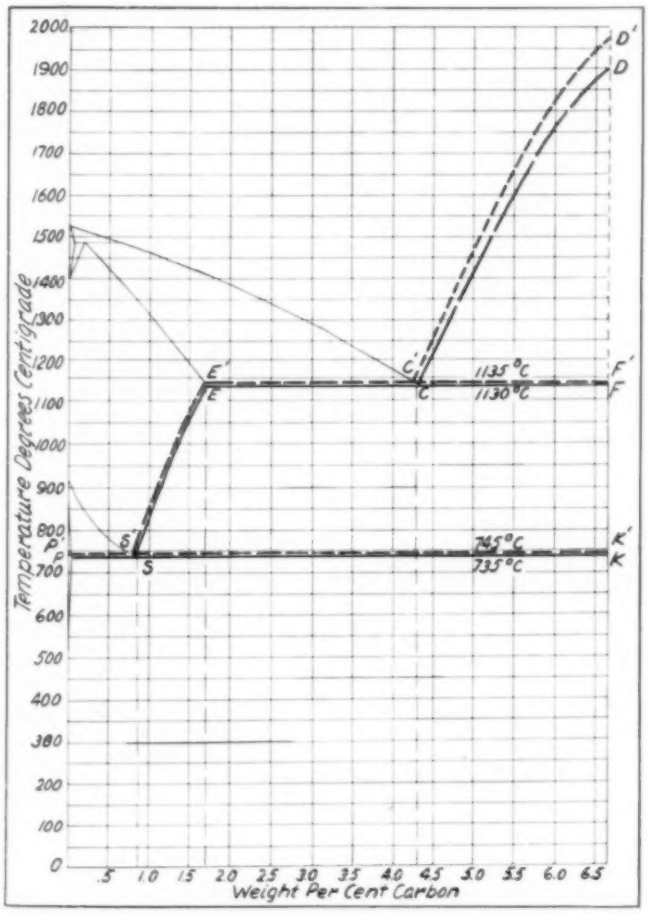


Fig. 52—Selected double iron-cementite, iron-graphite phase diagram from the chapter of the Alloys of Iron & Carbon prepared by Samuel Epstein at Battelle Memorial institute, to be published late in 1935

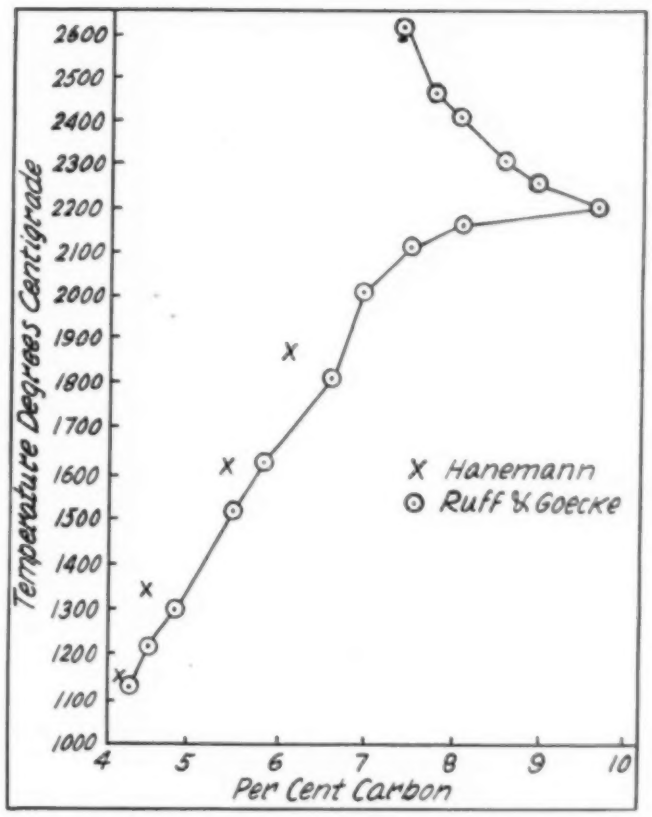


Fig. 53—Solubility of carbon in iron, as obtained by Ruff and Goecke and Hanemann, according to Sauveur

just to or a trifle below the eutectic temperature and then quenched. The nearer the quenching is conducted to the eutectic temperature, the more cementite is found. These points suggest that on passing through the final solidification, cementite is formed first and at some temperature slightly below the eutectic this cementite commences to break down, graphite being formed as one of the transformation products. Subsequent formation of graphite proceeds as the temperature is lowered, rapidly at first and more slowly as the temperature is lowered. The author has been unable to find any extensive quantitive data showing rates of graphitization for irons cooled from the liquid state, and at temperatures somewhat below the eutectic. It is well known that these rates vary enormously depending on the percentage of silicon and other elements present, whether the iron was superheated or not, on the presence of various gases, and on other factors.

3—When hyper-eutectic iron is cooled down, graphitic carbon often separates as kish. Kish frequently is found as shiny black loose plates in cavities in some pig irons. It is rather light and *air floats* readily. Kish frequently is observed separating from molten pig iron, and floating around, in that respect somewhat resembling slag wool sometimes noted during cupola melting. That kish formation, it is contended, is evidence of primary or direct precipitation of graphite. However, it must be remembered that to the (*Please turn to page* 48)

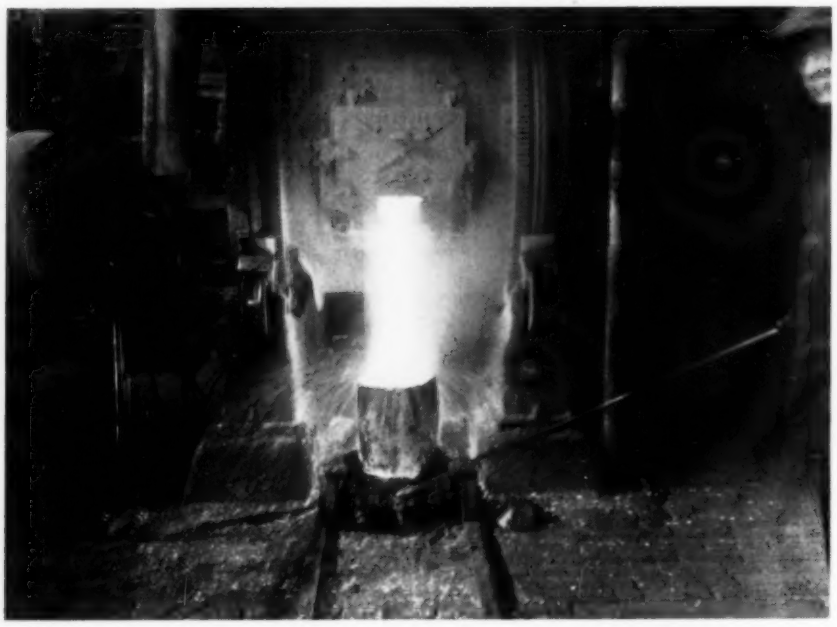


Fig. 1—The heated crucible mounted on a small truck is placed under the spout of the electric furnace

Manufactures Plumbers' Supplies

Foundry plays important part in plant engaged in production of pipe fittings

SEVENTY years ago when the population of the United States was beginning to readjust itself after four years of internal warfare, J. W. Hays, an ambitious young journeyman plumber in Erie, Pa., decided to adopt the late William Shakespeare's advice *in re* the tides in the affairs of men which taken at the flood lead on to fortune. He had to buy castings for his own use. Other plumbers in the town also had to buy castings. He reasoned shrewdly enough that by making his own castings he should be able to turn an additional honest penny coming and going. By selling castings to plumbers and other customers he should reap an additional reasonable profit. He set up a modest establishment and as the years went by discovered that in a general way and taking everything by and large, the late Mr. Shakespeare in modern parlance, had the right dope.

The business gradually expanded to a point where the existing plant no longer was adequate for manufacturing purpose. A large plant modernly equipped was erected at the southwest corner of Twelfth street and Liberty boulevard and in direct communication with the main line of the New York Central railroad. Here for many years under the able direction of O. G. Hitchcock, general manager, the Hays Manufacturing Co. has produced plumbing supplies for customers practically all over the United States. The company does not maintain branch warehouses, but ships goods to wholesale hardware and plumbing supply houses.

In addition to the general offices the plant includes a two story machine shop, plating department, foundry, metal pattern shop, pattern storage and power house. Alternating current is secured from an outside source, but direct current is generated in the plant. The boilers are fired with powdered coal. The coal is discharged through a trestle over a large concrete walled chamber from which it is carried to the pulverizer. Combustion is so complete that scarcely any smoke floats from the top of a 125-foot stack. Fine ash settles to the bottom of the stack and is removed at periodic intervals.

The foundry with accommodation for 28 molders is laid out in a manner that has become fairly standardized in recent years, that is the molding floors on either side extend from a central gangway to the walls where the molds are made on a battery of molding machines made by the Tabor Mfg. Co., Philadelphia. The finished molds are set up for pouring in a slanting position on devices constructed from 1-inch steel pipe attached to standards anchored in the brick

floor. In this manner the sprues of the molds are in a convenient position to receive the metal from the lips of the crucibles.

An exception to this method is found in one section of the shop where the molds are placed on four turntables as shown in Fig. 2. The table of light steel construction is attached to a central steel spindle mounted in bearings top and bottom. Additional rigidity is secured through six guy rods extending from radial points on the table to a cap at the top of the spindle. Usually the molds are poured before the table is filled, but in an emergency the molds may be stacked two-high. As with many other innovations, the introduction of the turntables at first met with opposition. Later as the men became accustomed to them, they learned to prefer them to the usual straight floor. This is readily understandable, since the turntable eliminates the necessity of carrying the molds any distance. A molding machine is located close to the perimeter of each turntable. The molder simply lifts the mold from the machine and places it upon the table, then moves the table the space of one mold.

Monorail Serves Turntables

A branch from the monorail over the central gangway extends to the side wall and in that manner serves the four turntables, two on either side. Crucibles arrive in constant succession and the metal is poured in turn into the molds on each of the four turntables. In like manner each turntable is revolved and the molds are dumped in one pile close to each molding station, where each molder cuts over his own sand. Other men remove the castings and truck them to the cleaning room.

Five electric furnaces made by the Detroit Electric Furnace Co., Detroit, are used; one 200 pounds, one 400 pounds and three 800 pounds capacity. On a 55-minute melting schedule this battery of furnaces has a daily melting capacity of approximately 30,000 pounds. Metal for short orders, special mixtures and other departures from the routine production is melted to some extent in pit furnaces, but their principal function is heaters for the crucibles.

A crucible receiving metal from one of the electric furnaces is shown in Fig. 1. The heated crucible is lifted with a tongs from the pit furnace and placed upon a small, low steel truck mounted on a short length of track. An attendant armed with a long hooked bar shoves the truck and crucible under the spout of the furnace. When the crucible is filled he pulls the truck forward under the monorail. A pair of tongs is attached to the (*Please turn to page* 66)

Fig. 2 (Top)—In one section of the shop molds are poured on four turntables. Fig. 3 (Upper Center)—The bail engages trunnions on the tongs. Fig. 4 (Lower Center)—The original installation of 20 pit furnaces has been superseded by 5 electric furnaces. Fig. 5 (Below)—Intricate and fragile cores are supported in dryer shells

Testing Society Studies Standards

Thirty-eighth annual convention proves advances made in science of metals

INTENSIFIED interest in all phases of scientific accomplishment is indicated by the results of the thirty-eighth annual convention of the American Society for Testing Materials, held in Detroit, June 24-28, with an attendance exceeding one thousand. While the work of the society primarily is devoted to formulating, proving and promoting specifications for materials, in late years the results of research have been presented at the annual conventions. Many times these research papers precede and indicate trends in scientific and commercial development.

The work of the committees, of necessity, is complex and intensely specialized, as is indicated by the fact that one main committee, A-1 on steel, employs a membership of about 200 and since its organization in 1898 has added special sub-committees with individual responsibility until 20 such committees are active. That these and other committees have been effectively employed is evidenced by the number of new specifications, revisions and standards that are announced which are immediately important to the foundry industry.

Relies on Close Specifications

Presiding at the opening session F. O. Clements, research director, General Motors Research Laboratories, Detroit, welcomed visitors on behalf of the local section of the society and introduced Harvey J. Campbell Jr., Detroit Board of Commerce, who gave the civic welcoming address. Mr. Campbell traced the growth of the city as a manufacturing city and stated that the past developments are due to attention given to transportation, to free labor and to clean government. He paid caustic comment to the obstacles confronting industry in the limitation of these basic principles.

C. F. Hirshfield, chief of the research department, Detroit Edison Co., outlined the dependence of engineering upon the ability to closely specify materials. More expeditious handling of specification development was urged.

In the address, delivered by the retiring president, Hermann von Schrenk, the relationship of specifications for various materials to each other was stressed. A study of existing specifications for a wood house shows that 96 different materials are available. Even with these, numerous gaps are present and the inter-dependence was shown by the ability to supply shingles that are specified to last for generations and the absence of specifications for nails that will last more than a few years. He urged the more frequent exchange of information, through symposiums covering numerous materials, to acquaint the specialists in various fields with the facilities or lack of specifications on the materials that are grouped in engineering structures.

The tenth Edgar Marburg lecture was held Wednesday afternoon at 4 o'clock. Hermann von Schrenk, president of the society, introduced Dr. L. B. Tuckerman, National Bureau of Standards, who spoke on aircraft materials and methods of testing them.

Dudley Medals Were Presented

The annual dinner of the society was held Wednesday evening with Charles F. Kettering, General Motors Research Laboratories, Detroit, as toastmaster. Following the dinner President Hermann von Schrenk presented the Charles B. Dudley medal to C. A. Hogentogler and E. A. Willis which was awarded to them for their paper, "Subgrade Soil Testing Methods," presented at the 1934 meeting. After dinner speakers were J. E. Burchard, Bemis Industries Inc., Boston, and Miles Colean, Federal Housing Administration, Washington.

Some of the phases relating to wrought iron, steel and cast iron were covered in the fourth session held Wednesday morning, under W. M. Barr, Union Pacific Railroad Co., Omaha, Neb., as chairman. The session was opened with the report of committee A-2 on wrought iron which was presented by G. H. Woodroffe, Reading Iron Co., Philadelphia.

In the absence of Thomas Spooner, Westinghouse Electric & Mfg. Co., East Pittsburgh, chairman of committee A-6 on magnetic properties, report of that committee was presented by P. J. Smith. The report recommended publication of several proposed revisions and additions to the standard methods of tests for magnetic

properties of iron and steel, and a proposed tentative definition of terms with units and symbols, relating to magnetic testing.

Report of committee A-1 on steel stated that three standard specifications under its jurisdiction have been approved by the American Standards association. Those related to carbon steel castings for valves, flanges and fittings for high temperature service; alloy steel bolting material for high temperature service, and forged or rolled steel pipe flanges for high temperature service. The committee withdrew tentative specifications relating to carbon steel castings for industrial, railroad and marine uses, and work is being conducted so that separate specifications for each type may be submitted at an early date.

H. S. Vassar

New Officers

President

H. S. Vassar
Laboratory engineer, Public Service Electric & Gas Co., Irvington, N. J.

Vice President

A. E. White
Professor of metallurgical engineering and director of department of engineering research, University of Michigan, Ann Arbor, Mich.

Executive Committee

W. H. Graves
Chief metallurgist, Packard Motor Car Co., Detroit

R. L. Hallett
Chemist, National Lead Co., Brooklyn, N. Y.

N. L. Mochel
Metallurgical engineer, Westinghouse Electric & Mfg. Co., Philadelphia

H. H. Morgan
Manager, rail and fastenings department, Robert W. Hunt Co., Chicago

W. R. Webster
Chairman of board, Bridgeport Brass Co., Bridgeport, Conn.

A. E. White

C. H. Gibbons, Baldwin-Southwark Corp., Philadelphia, presented a paper on the effect of cold bending on the elastic properties of heavy steel plates. The plates tested were 3½ inches thick, and were of two compositions containing respectively 0.17 and 0.27 per cent carbon, designed for cracking still service. Results obtained indicated that unless the plates were normalized after cold bending, lower physical properties were obtained.

Hyman Bornstein, Deere & Co., Moline, Ill., chairman of committee A-3 on cast iron, then presented his report which recommended publication of a proposed tentative standard for automotive gray iron castings which are identical in substance with those of the Society of Automotive Engineers. Work by subcommittee VI on general castings led to the elimination of the separately cast tension test bar in the tentative specifications for gray iron castings. Revisions were made in the tentative specifications for cast iron culvert pipe, and definitions relating to cast iron, pig iron, gray iron, white iron, mottled iron, malleable cast iron, semisteel, and high test cast iron were proposed. A revised tentative specification for chilled tread, cast iron car wheels was withdrawn by the committee for further study, due to the lack of agreement with the American Association of Railways' limitation of phosphorus to 0.35 per cent.

The session closed with a paper by J. O. Almen and A. L. Boegehold, General Motors Corp., Detroit, on factors which influence the life of rear axle gears. Results obtained by the authors indicate that machining and other processing operations have a greater effect on gear life than composition and heat treatment, provided the gears can be processed satisfactorily, and that tooth failures may be plotted on the familiar stress-cycle curve when gear stresses are calculated properly.

Several written discussions of the paper were presented by R. E. Peterson, Westinghouse Electric & Mfg. Co., East Pittsburgh; W. B. Eddy Jr., General Motors Truck Corp., Pontiac, Mich., and H. W. McQuaid, Republic Steel Corp., Massillon, O. T. M. Jasper, A. O. Smith Corp., Milwaukee; T. H. Wickenden, International Nickel Co., New York, and Dr. L. B. Tuckerman, National Bureau of Standards, also discussed the paper. The latter called attention to lack of good design and faulty workmanship as being the greatest factors causing failure.

In opening the second session Tuesday, President Hermann von Schrenk called upon T. R. Lawson, Rensselaer Polytechnic institute, Troy, N. Y., and chairman of committee E-10 on standards, to present the report of his committee.

P. H. Bates, National Bureau of Standards, Washington, presented the report of committee E-9 on research, pointing out that the joint committee on investigation of the effect of phosphorus and sulphur (*Please turn to page 70*)

Influence of Temperature Gradients In Producing Steel Castings

By GEORGE BATTY

IN THE production of steel castings in sand molds or in molds formed of other refractory materials, a great deal of attention has been given to the provision of feed heads of adequate size and proper location to promote soundness —freedom from that mid-section cavity known as enclosed pipe — in all parts of the piece. As the complexity of the design increases, and as sharply differential sections are conjoined or relatively heavy masses imposed on a generally lighter structure in positions which are difficult to reach with feed metal, the difficulty in promoting soundness throughout the complete structure generally increases.

The casting of complex design presents additional difficulties which increase liability to failure, resistance of the mold to normal contraction of solidified metal introducing the tendency to hot tearing or cracking. Despite this fact, it is a common foundry experience to find that among the castings most difficult to produce of a grade that is both commercially satisfactory and free from serious metallurgical deficiencies, are pieces of harmonious or simple design such as hammer blocks and gear blanks.

In part this is due to the relation of area to mass and in part to the system of gating and heading employed. The relation of surface area to mass of cast metal is briefly but illuminatingly commented upon by Briggs and Gezelius—*Transactions*, A.F.A., 1933 — who made a series of four pairs of castings—each pair being a sphere and a parallelepiped — and determined the rate of skin-formation or actual solidification by turning over the mold after a predetermined time interval and pouring out through the gate the metal which remained liquid.

The sphere and the rectangular block were of identical volume but the parallelepiped was of 50 per cent greater surface area than the sphere. The rate of skin formation was found to be almost identical for both sphere and block, but the point of the greatest significance to the practical foundryman is that, in the same time intervals, approximately 50 per cent more metal solidified in the mold producing the parallelepiped than in that producing the sphere.

This set of experiments illustrates what may be defined as *rate of feed demand*, which is important to the founder in determining size and shape of the feed head to be imposed to promote the internal soundness of the casting. Therefore, shape or design of a casting must have some considerable bearing upon the ultimate cost by reason of the amount of metal necessary to produce the piece and the concomitant cost of cleaning off the discard.

It is not necessarily to be assumed that rate of solidification of the parallelepiped will continue to be 50 per cent greater than that of the sphere, but the reported results of the series of tests show strikingly that the distance of the center of the mass from the two nearest opposed mold faces has a profound effect upon the rate of solidification — expressed as a progressive proportion of the weight, not as linear thickness of the continuously thickening solidified envelope — and, therefore, upon the rate of demand for the metal from the superimposed feed head.

In the case of the sphere the

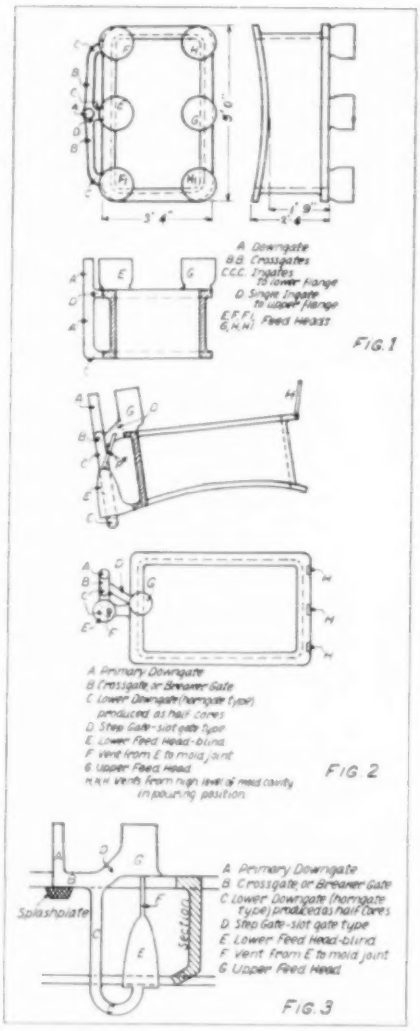

A. Downgate
B.B. Crossgates
C.C.C. Ingates to lower flange
D. Single Ingate to upper flange
E.F.F. G.H.H. Feed Heads
FIG. 1
A. Primary Downgate
B. Crossgate or Breaker Gate
C. Lower Downgate (horngate type) produced as half cores
D. Step Gate-slot gate type
E. Lower Feed Head-blind
F. Vent from E to mold joint
G. Upper Feed Head
H.H.H. Vents from high level of mold cavity in pouring position
FIG. 2
Splashplate
A. Primary Downgate
B. Crossgate or Breaker Gate
C. Lower Downgate (horngate type) produced as half cores
D. Step Gate-slot gate type
E. Lower Feed Head-blind
F. Vent from E to mold joint
G. Upper Feed Head
FIG. 3

Fig. 1—Orthodox method of heading and gating. Fig. 2-3-A second method of heading and gating

center of the mass of the casting proper is equidistant from every part of the mold-metal interface, which, giving the lowest possible ratio of surface area to mass, predicates the slowest rate of feed demand and, in practice, the greatest amount of metal to be imposed as a feed head to promote soundness of the cast structure. Briggs and Gezelius did not state the dimensions of the rectangular piece used in their experiments for comparison with the sphere, but what they demonstrated in their comparison also may be applied to a consideration of rectangular shapes of different ratios of surface area to mass. Within fairly well defined limits — prescribed by the *castability* of the metal — it is easier to produce commercially satisfactory castings, in relation to internal soundness, as the ratio of surface area to mass increases.

The massive casting, say a hammer block, is more difficult to produce free from shrinkage cavity and is more expensive in the amount of metal required, plus the cost of cleaning, than is a piece of similar weight, say a simple baseplate, having a much larger ratio of surface area to mass.

Orthodox Method of Gating

The foregoing discussion has had relation to castings produced by what may be considered orthodox steel foundry practice in relation to gating, heading, and pouring procedure—gating into the base of the mold cavity; either filling the mold completely, including the feed head, through the downgate or filling the mold proper through the downgate and then filling up the head by pouring directly into it; by using metal as cool as possible, and by filling the mold as quickly as possible. Under such governing conditions it is not possible, even on the simplest forms of castings, to have any pronouncedly favorable temperature gradient in the metal at the moment the mold is filled and, by reason of the gating employed, the mold will

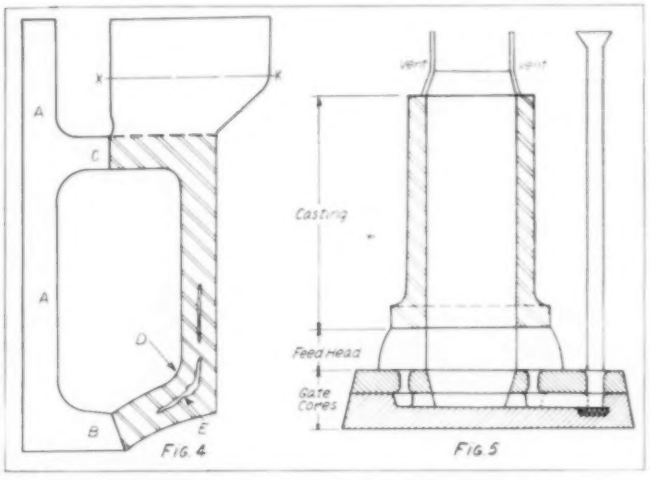


FIG. 4 FIG. 5

Fig. 4—Section of casting poured by the orthodox method. Fig. 5—Hollow cylinder having almost uniform wall thickness from collar to end

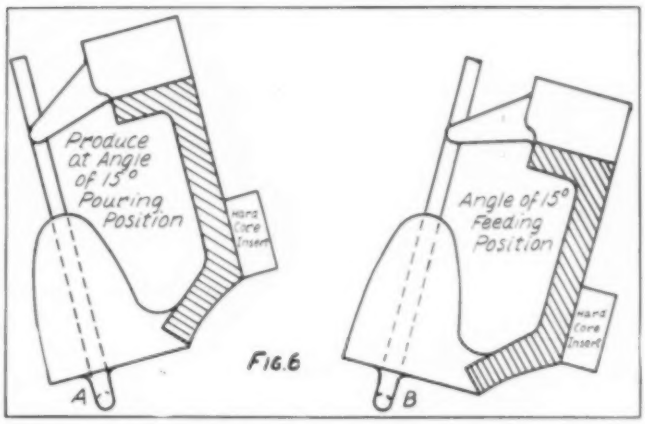


FIG. 6

Fig. 6—Gating and heading system used on the partial reversal method

have acquired an adverse temperature gradient related in degree to the pouring rate and to the section thickness of the casting.

Section thickness must be considered in relation to pouring rate (rise of metal in mold per second) and it is common foundry practice to ensure a high pouring rate for light sections—a cylinder cast vertically for example. Despite that fact, there is likely to be produced in both mold and casting a distinctly adverse temperature gradient which is inimical to the ultimate integral soundness of the cast structure. The observed fact that the metal which appears in the risers and vents of a bottom-poured casting is much cooler than the metal delivered to the downgate is such a foundry commonplace, so thoroughly in accord with what is expected, that its significance is not appreciated.

May Promote Unsoundness

The obviously adverse temperature gradient in the metal has been noted and feed heads provided of such shape and capacity as to show sound metal when they were cut off and the casting dressed down to the proper size. If the feed heads have to be relatively large to promote such apparent soundness and if they are filled through the casting—as distinct from being filled individually from the open top—they may help to promote unsoundness in the lower levels of the casting by causing more metal to be passed through the mold, whereby the adverse temperature gradient is increased in both mold and metal.

So far as the feed heads themselves are concerned they, being necessarily of considerably heavier section thickness than the part of the casting upon which they are imposed, become reservoirs of heat in proportion as they are reservoirs of metal and so produce, strictly locally, a favorable temperature gradient. Hence, the apparent soundness of the casting immediately below such feed heads. To indicate the relevance of temperature gradients a type of casting has been chosen for discussion which had given some (*Please turn to Page* 52)

Toronto Beckons with A.F.A. Convention and Canadian National Exhibition

MANY features of the annual convention of the American Foundrymen's association, to be held at the Royal York hotel, Toronto, from Aug. 20 to 23, will be especially attractive to visiting foundrymen. The tentative technical program for the meeting, recently announced by Robert E. Kennedy, technical secretary of the association, covers an unusually wide field of problems relating to all branches of the foundry industry. Coupled with shop courses, committee meetings and round table discussions, the entire program of the convention should aid materially in the march of progress of the industry.

Other features of the first meeting in Canada in a number of years, include the splendid facilities for vacationing in Toronto and other parts of the Dominion; the many points of interest in the convention city and the surrounding territory; the many modern foundries located in the district; and the opening of the Canadian National exposition which coincides with the last day of the A.F.A. convention.

Special Meetings Feature Program

Several special meetings are included on the technical program. An important session on industrial health hazards and employer responsibilities will be held Wednesday evening with Dr. W. J. McConnell, assistant medical director and director of industrial health section, Metropolitan Life Insurance Co., New York, and Donald L. Cummings, assistant director, Saranac Laboratories, Saranac Lake, New York. These speakers have made important contributions to a special study of industrial health problems, especially as related to the question of dust conditions. This session will be supplemented by a second meeting at which the engineering aspects of dust collection will be surveyed by S. D. Moxley, American Cast Iron Pipe Co., Birmingham, Ala.

Due to the increasing shortage of skilled men in the foundry industry, the session on apprenticeship training is especially important at this time. J. E. Goss, employment manager, Brown & Sharpe Mfg. Co., Providence, R. I., and V. E. Hydar, director of personnel, Falk Corp., Milwaukee, who will speak at that session, are connected with firms who have been unusually successful in apprentice training work. Other sessions of general interest include foundry materials handling, refractories and sand research.

While those interested in the practical phases of foundry production will find much of interest in the regular sessions, two shop operation courses, each consisting of three sessions, will be devoted to foundry sand control and iron foundry melting. The shop courses will cover new

sand qualities, natural sand uses, and the application of synthetic sands. Two of these sessions will be held on Tuesday and Wednesday evenings to permit the attendance of all foundrymen in the Toronto district. Four round table luncheons, covering the major branches of the castings industry, will be held Thursday afternoon. The nonferrous conference will be devoted to a study of castings which have presented problems in production. Illustrations of molding methods, gates and risers, etc. will be shown with lantern slides. Harold J. Roast, Canadian Bronze Co., Ltd., Montreal, and chairman of the nonferrous division committee of the association will be in charge of the conference.

The round table on cast iron will discuss the "Effects of Nitrogen and Oxygen in Cast Iron," under the leadership of W. H. Spencer, Sealed Power Corp., Muskegon, Mich. The steel and malleable conferences will be devoted to the discussion of problems introduced from the floor. A. W. Gregg, works manager, Farrell-Cheek Steel Foundry Co., Sandusky, O., is in charge of the steel foundry session, and P. C. DeBruyne, superintendent, Moline Malleable Iron Works, St. Charles, Ill., will lead the discussion at the malleable conference.

The wide diversity of subjects to be discussed during the convention is well illustrated in the following tentative program:

Monday, Aug. 19

Committee Meetings

Tuesday, Aug. 20

10 a.m. to 11 a.m.—*Opening Meeting*

Formal Convening of 39th Annual Convention.

Address of Welcome, by L. L. Anthes, chairman, Toronto Foundry committee.

Response by President Dan M. Avey.

Reports of officers.

11 a.m. to 1 p.m.—*Cast Iron*

"Impact Resistance and Other Physical Properties of Alloy Cast Iron," by G. P. Phillips, International Harvester Co., Chicago.

"Heat Treatment of Cast Iron," by R. G. McElwee, Ecorse Foundry Co., Ecorse, Mich.

"Hardening Anneal of Austenitic Iron," by G. R. Delbart, Denain, France.

11 a.m. to 1 p.m.—*Foundry Sand Research*

"The Expansion and Contraction of Molding Sand Under Elevated Temperatures," by H. W. Dietert, H. W. Dietert Co., Detroit.

Reports of Committees

Committee on Tests
Committee on Durability
Committee on Fineness

Afternoon—*Plant Visitation*

8 p.m. to 9 p.m.—*Sand Shop Course* (Session 1)

New Sand Qualities

Chairman—Neil I. MacArthur, Great Lakes Foundry Sand Co., Detroit.

Discussion Leader—George F. Pettinos, George F. Pettinos Inc., Philadelphia.

9 p.m. to 10 p.m.—*Cast Iron Shop Course* (Session 1)

Special Irons from High Frequency Electric Furnaces

8 p.m. to 10 p.m.—*Refractories*

"Insulation of Furnaces Applicable to Foundries," by A. V. Leun, Bethlehem Steel Co., Bethlehem, Pa.

"Malleable Furnace Refractories," by L. C. Hewitt, Laclede-Christy Clay Products Co., St. Louis.

"Importance of Equilibrium Studies in Cupola Refractories," by A. H. Dierker, Ohio State University, Columbus, O.

Wednesday, Aug. 21

9 a.m. to 11 a.m.—*Malleable Cast Iron*

"Endurance Tests of Malleable Iron," by E. G. Mahin, University of Notre Dame, and J. W. Hamilton, Bendix Products Corp., South Bend, Ind.

"Effects of Various Elements on Malleabilizing," by O. W. Ellis, Ontario Research Foundation, Toronto.

"Notes on the Production of Cupola Iron Fittings," by F. B. Riggan, Stockham Pipe & Fittings Co., Birmingham, Ala.

Report of Committee on Specifications

Report of Committee on Nomenclature

9 a.m. to 11 a.m.—*Materials Handling and Foundry Equipment*

"Mechanical Charging for Small Tonnage Foundries," by D. J. Reese, Whiting Corp., Harvey, Ill.

"Mechanical Handling of Sand and Castings for Small Tonnage Plants," by E. W. Beach, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.

11 a.m. to 1 p.m.—*Cast Iron*

"Structure and Properties of Gray Cast Iron," by A. Di Giulio and A. E. White, University of Michigan, Ann Arbor, Mich.

"Railroad Castings," by A. Reyburn, Canadian National Railways, Montreal.

"Piston Rings," by T. R. Twigger, British Piston Ring Co., Holbrook Lane, Coventry, England.

11 a.m. to 1 p.m.—*Foundry Costs*

Afternoon—*Plant Visitation*

(*Please turn to page* 58)

Much of our knowledge is acquired by practical observation. Photo courtesy American Gas association and John Harsch Bronze & Foundry Co., Cleveland

Overcome Defects Through Study

Industrial conference method of education recommended for analysing difficulties

By W. M. BALL JR.
Edna Brass Co., Cincinnati

OVERCOMING defects in castings is one of the many problems every foundryman must face. Experience brings these problems to light and it then is necessary to be prepared to meet the difficulties. Through classification and study of defective castings, some method of attack may be developed. One method of analysis, which would aid in overcoming these problems, is called the industrial conference method of education, and is a scientific plan for blending practical experiences with science and theory.

Engineering, which has many different definitions, may be considered best as the application of known facts, or the art or skill of organizing and directing men and the controlling of forces and materials of nature for the benefit of the human race in its almost infinite activities.

In recalling the experiences of supervisors in the foundry and thinking of the many excuses for defective work, it has been found most common for the supervisors to place the blame on some material thing, such as the furnaces, patterns, fluxes, etc. It may be possible that these excuses have been worked too much and the supervisors have lost sight of the fact that it might be in the art or the skill of organizing and directing the human side of engineering.

Knowledge Gained Through Experience

It has been said that our knowledge is mostly practical and acquired by observation alone without due regard to science and theory. Observation in its true sense not only is seeing but is knowing what is seen. This can be acquired only in the foundry where practice and experience are used in conjunction with due regard to science and theory. After we have attained keen observation we then have the most outstanding and valuable characteristic that a

foundryman can possess, that is, the ability to recognize. It has been said that when a problem once is squarely recognized its solution is sure to follow. Then, through the power of scientific analysis and deduction it will be possible to eliminate those things and conditions which we know are not interfering and to set up a logical attack on our problem.

Before proceeding with a method of attack it may be best to give an experience to show how it was possible through observation to make good castings using the same materials and equipment that had been used when the castings proved defective, only taking into account the application of known facts. This experience was the making of cast steel wheels 6 feet in diameter and having a 20-inch face. The pattern was of the split type of construction and the spokes were formed by 16 triangular cores.

Shrinkage Had to Be Considered

A knowledge of engineering indicated it was evident that it would be impossible to make these castings until the laws of science were applied. In a wheel of that size there would be a natural shrinkage of 3 to 4 inches in the periphery and about 1-inch in each of the spokes, which would have to be taken into consideration. It was first suggested that the number of spokes be changed to 13 so that no two spokes would be pulling directly opposite each other. Then, too, have the pattern changed so that the spokes could be molded instead of being made by the cored method. After receiving the changed pattern two molds were made by first facing the pattern with a good facing sand, then backing up and filling in between the spokes with a mixture of sawdust and sand thereby permitting the castings to shrink naturally. The first two wheels that were poured when shaken out showed excessive straining or swelling in the spokes. Due care then was taken to see that the next two wheels were poured with some degree of care but an inspection showed a slight amount of cracking in the rim.

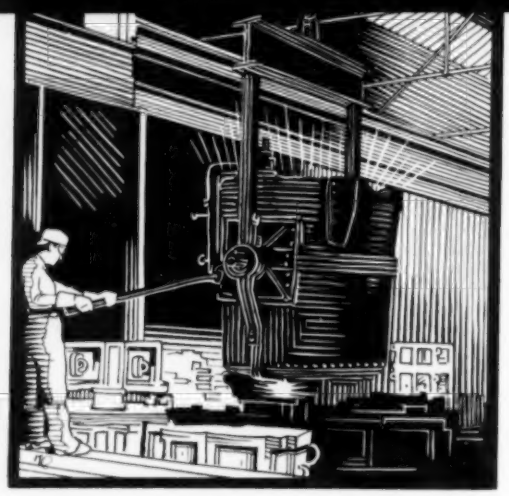
After a careful check, it was evident that the pattern and the molding were satisfactory. Orders were given to stop making any more castings until further notice and a test bar was cast in the next six succeeding heats for the purpose of checking the metal. After making the necessary physical tests it was possible to show the melter where the metal was at fault. With the whole-hearted co-operation and the best practical experiences of the melting department, two more of the wheels were cast, which on inspection proved to be perfect castings and the entire order was finished without further delay.

To cite a further illustration, a certain nonferrous foundry producing about 50 to 100 tons of castings a day, was experiencing difficulty with porous castings and seemed somewhat at a loss to determine just what was the cause. After spending two days in the plant and going over each item in the making of castings, it was observed that while the metal seemed to have sufficient temperature for pouring, it showed signs of being thick and sluggish. That naturally would point to the metal or the melting. Upon investigating the melting equipment, it was found that the furnaces were of the open flame type and connected up in pairs to one positive blower and that there was no scientific control for any variations, the operation being left entirely to the human element. With this point in mind it was suggested that six castings of difficult design be made and that the melting operation be checked closely so as to attain the best possible conditions. After those castings were cleaned three of them were machined and broken. All proved satisfactory showing no signs of porosity or segregation. Again as in the first case it was the ability to observe and recognize the trouble and then to set up some logical attack to be able to use the same materials and equipment that were previously being blamed for the defective work.

Three Types of Education

Twenty years experience in the operation of foundries naturally would bring out many types of trouble and show the necessity for some method of adult education for the elimination of troubles encountered in daily work. There are three types of education. The first and most common is the instructional type with a group of students and a teacher or an instructor. It is the duty of the instructor to impart those things or facts to be learned to the student who will have to stand test or examination. Our public schools and universities are examples of that type of learning. Second, is the lecture type where a speaker delivers a discourse to a group on some topic; but in this case probably there will be no two who will receive the same amount of information or will have the same interpretation of what is said nor will the group be called upon for an examination except when it is used in conjunction with the instructional type of training. Third is the industrial conference type of training, with a leader and a chosen group. It is a requirement that the group has had experience and the leader though not necessarily required to know all about the topic to be discussed must have the ability to lead this group in the discussion and to record it systematically on a blackboard so as to get a blend of ideas and a unanimity of thought and to determine the best possible solution to the problem.

A symphony orchestra may be compared to the industrial conference type of training. An orchestra, made up of skilled artists, is only successful in direct ratio to the ability of the conductor to lead them and to bring out their abilities at the proper time and to blend them in harmony to produce a (*Please turn to page* 60)



QUESTIONS and ANSWERS

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

Discusses Use of Petroleum Coke in Melting Iron in the Cupola

What are the advantages or disadvantages of using petroleum coke for melting gray iron in a small cupola?

The advantage of using petroleum coke in the cupola is that the carbon content is higher and the sulphur and ash content lower than in the usual species of coke made by the by-product or beehive process from bituminous coal. This means that a relatively smaller quantity will melt a given amount of iron, the volume of slag will be reduced and the sulphur pickup practically will be eliminated. These advantages are offset by the fact that petroleum coke is high priced as compared with other cokes.

A proprietary type of petroleum coke is manufactured for use in cupolas melting bronze and is claimed to be admirably suited for the purpose. The ordinary grade of petroleum coke is much softer than ordinary coke and therefore is not particularly well adapted to supporting the burden in a cupola. Also, as usually supplied this coke is in the form of lumps too large to use in a small cupola and a great deal will be wasted in breaking it. Briefly stated, petroleum coke may be used to melt iron in the cupola, but it cannot compete with by-product or beehive coke on an economical or convenience basis.

Add Part of Phosphorus In Furnace and Balance in Ladle

We are sending a piece of bronze bushing which has been broached. The fracture of this bushing seems to show that the metal has been slightly gassed in melting and this we believe is the reason for the broach tearing. We melt with an electric furnace and the metal is poured into a heated pot on charcoal and about 2 to 4 ounces of phosphorus to the hundred is placed on the bottom of the pot. We sometimes replace the phosphorus with 1 or 2 per cent zinc, then the casting shows a close grain and it broaches out smoothly. However, we cannot use the zinc method at all times because of the analysis.

The bronze appears to be sound and of at least average quality. The tearing of the surface by the broaching is peculiar to that method of machining the bore of a bushing.

It is possible that by increasing the length of a broach and arranging the cutters so that each will take a small cut, the bite on tearing would be reduced to a minimum. Obviously, as you increase the size of the bushing, the amount of force exerted for a given bite is increased; consequently developing an increase in the amount of tear as the size of the bushing is increased. This explains why in the case of small sizes you experience less difficulty. It is probable that even in the small sizes there is some tear. It generally is admitted that the broaching process is not the most desirable method of tooling a bearing surface to insure the maximum bearing life.

We believe that your method of manufacturing your alloy is satisfactory; although you may find that averaging over a large number of heats you would find a higher average of quality, if you made it your regular practice to add a part of your phosphorus to the melt in the furnace and the balance in the ladle.

Wants Nonferrous Alloy For Handling Acid Mixture

Can you give us a nonferrous alloy which will resist a mixture of sulphuric and nitric acids?

As far as we know there is no nonferrous alloy which will withstand the combination of mixed sulphuric and nitric acids. The latter is what is termed an oxidizing substance and rapidly attacks most copper-base alloys. Incidentally, to obtain specific information on what material could be used, it will be necessary to know

the exact concentrations of each of the acids in the solution, whether handled hot or cold, whether aerated or not, and whether the acids are present as acids or salts of the acids.

Manufacture of apparatus for the chemical industry is a highly specialized line, and requires knowledge that only is gained by long experience and continual experiment. Possibly one of the high nickel-high chromium irons or steels might serve, or high silicon iron castings (Duriron), but in any event it will be necessary for the supplier to know all the details mentioned previously before he can tell whether his material will fill the bill.

Use Both Aluminum and Manganese Bronze for Propellers

What are the particular advantages in using aluminum bronze alloy for propellers? We always have used manganese bronze. We have considerable trouble with galvanic action and wondered if using aluminum bronze alloy would lessen the difficulty.

Advantage of aluminum bronze over manganese bronze for propellers is the difference in the weight. Manganese bronze weighs about 0.303 pounds per cubic inch, whereas aluminum bronze weighs 0.270 pound per cubic inch, a saving in weight in the use of aluminum bronze of about 10 per cent. Of course, these figures cannot be considered as absolutely accurate because manganese bronze itself is a name for a number of different alloys, each of which may vary slightly from the figure given. and the same is true of the term aluminum bronze, but the ratio between the two is about correct.

The shock resisting value of aluminum bronze also has an advantage where propellers are likely to be subject to severe shocks as a result of obstacles in the water. The difference in weight, however, has a two-fold value; first, being lighter may mean a reduction in the piece price, and second, the less weight is helpful in the problem of balance, and also the problem of total weight on the end of a long propeller shaft.

You suggest that you have trouble with galvanic action. We presume you mean by this galvanic action set up between the steel shaft or steel bearing post and the bronze wheel when submerged in, for example, salt water. This galvanic action is, of course, to be expected where two dissimilar metals are immersed in liquid bath that can act as an electrolyte. The relative action may be changed by the substitution of aluminum bronze for manganese bronze, but theoretically it would appear that the change would not be a complete cure since you still have bronze in contact with steel under the same conditions.

It generally is conceded that manganese bronze is relatively satisfactory for propeller wheels and likewise aluminum bronze is very satisfactory for this service. As to which is preferable for some particular type of service it is hard to state without knowing exactly the service requirements.

Analysis of Iron Is Factor Governing the Depth of Chill

We are making a small iron casting on which two areas are chilled. The first lot of castings was satisfactory, but the second lot did not wear as they should. We use a cast iron chill. Would a cast steel chill give any better service? Is a change in the analysis of the iron or some other factor responsible for the difference in chill penetration on the two lots of castings?

Analysis of the iron practically is the only factor to be considered in the manufacture of chilled castings. Analysis varies with the thickness of section. While in the molten state all carbon in the iron is in the combined form. Where the iron is cooled rapidly some of this carbon remains in the combined form, while the remainder separates out as free or graphitic carbon. Other elements, notably the silicon affect the separation of the carbon.

If you are interested you will find the subject covered in *Principles of Iron Founding*, by Moldenke. If, as we assume you are not interested in the subject in general, but interested only in the production of a suitable chilled surface on a certain small casting, then it is sufficient to say that you will have to stick to a definite analysis to secure castings with a uniform depth of chill. For a ½-inch section the silicon content must be below 2.00 per cent. So far as the chilling is concerned there is no difference between cast iron or steel chills.

Electric furnace used for melting aluminum bronze alloy for die casting and permanent molds casting at the East Pittsburgh works of the Westinghouse Electric & Mfg. Co. The workman is pouring the alloy into a holding pot

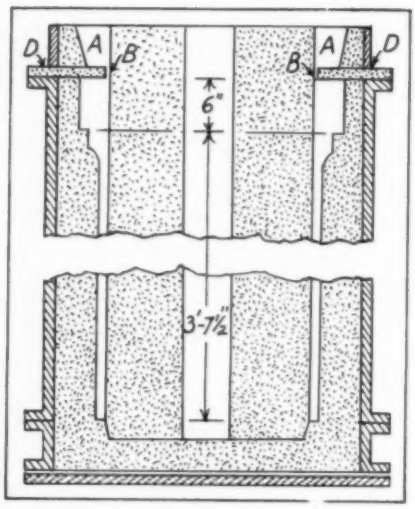
Cylinder Liner Shows Shrinkage at Top

We are enclosing a sketch of a diesel engine bushing 43½ inches in length, 14½ inches outside diameter, 1-inch metal thickness which is cast in a vertical position and which shows shrinkage on top when the riser is cut off. The casting is extended 4 inches on top for a shrink head. One was cast under a cope with a heavy riser and fed with a rod. A second was cast open and fed with hot metal. Shrinkage was the same in both cases. The mold is gated at the bottom. The iron shows a tensile strength of 35,400 pounds per square inch made up of a mixture containing 20 per cent steel, 1.75 per cent nickel and 0.50 per cent chromium.

The trouble with your bushing does not lie in the metal or in the manner in which it is melted, but in the molding practice. A possibility exists that the shrinkage to which you refer may be caused to some extent by a mold or core which causes the metal to boil. Metal in that condition freezes much more rapidly than iron in a normal condition and thus prevents the proper functioning of the feeder. The condition is aggravated by the position of the gate on the bottom since the hottest metal in the casting is in the bottom and the coldest metal is on top.

Another possible cause of the shrunken area on top may be a mold that is not sufficiently rigid to withstand the static pressure of the metal. After the mold is filled, the walls may yield a little and the metal sinks. A third theory is that a certain amount of dirt or slush may have floated up with the iron and lodged in the upper section. When exposed by the tool, it mistakenly may have been diagnosed as a shrinkage defect. Any or all of these troubles may be avoided by making the mold as shown in the accompanying illustration. The mold is made in dry sand in an iron flask. The core is made from a coarse, open sand mixture containing a minimum amount of binder and with a large opening, say, 5 or 6 inches diameter in the center to insure exit for the vent.

The core also is made long enough to extend 6 or 8 inches above the top of the casting and thus form the inner wall of the pouring basin. A ring 2 inches diameter larger than the pattern and about 6 inches high is placed on top of the pattern for a sink head and feeder. After the mold is dried and cored, a flat ring core *B* is placed on top of the mold and around the center core which it embraces snugly. This ring core contains ten small notches ¼ x 1½ inches which serve as pop gates. The dry sand runner basin or ring *F* is



Metal from the pouring basin *A* enters the top of the mold through ten small pop gates *B* in the inner edge of the ring core *D*

placed on top of the core. In a pinch a green sand basin might serve, but a dry sand basin is safer. A mold made in this manner, clean, rigid, dry and porous will produce a clean, solid casting irrespective of the composition of the metal which might be employed for making it.

Check Molding And Gating Practice

We are having trouble with small castings which must stand a water test. Our present iron analysis is silicon, 2.43 per cent; manganese, 0.46 per cent; graphitic carbon, 2.82 per cent; combined carbon, 0.59 per cent; phosphorus, 0.588 per cent, and sulphur 0.092 per cent. The castings are such a small percentage of our total production that we cannot make a special charge of iron. Will you please advise what we may add to our hand ladles to give us a grade of iron that will be more likely to stand a water test?

While the analysis you give for the castings is what is known as a soft iron, we cannot see why it will not serve satisfactorily in small castings which must withstand water pressure. Our suggestion is that you check your molding and pouring practice carefully to see that you are obtaining good, solid castings. See that the castings have adequate risers which are high enough to give a good head of metal. Also see that the mold and cores are well vented.

Possibly the addition of a small amount of chromium, say 0.25 per cent, in the ladle might close up the iron, but to obtain the beneficial effects of an alloy, the base mixture should be adjusted first. Again in dealing with small quantities of molten metal, it must be extremely hot to insure incorporation of the alloying agent, and also it must be stirred well.

Other Elements Are Present in Brass

We are enclosing 2 samples of cast from pig brass of composition 85-5-5-5, containing an additional amount of lead approximating 1 per cent which was added before pouring. The melts in both cases were kept under charcoal while melting so any loss of zinc or tin would be by vaporization during melting.

We would appreciate your giving us the benefit of your knowledge as to the cause for the poor condition of sample marked 2.

It would appear that the melting of both samples was done where you had a complete record of all operations. Therefore, we are forced to assume that the melting of the two melts was under identical conditions, eliminating any chance that melting had an influence on the malleability and appearance of the castings. Therefore, it is obvious that a chemical analysis of the two samples would be the most promising method of determining the difference in the two materials. That of course, is the most accurate and definite way to ascertain the exact composition of each of the alloys.

The skin of No. 2 is such that one would jump to the conclusion, without analysis to prove to the contrary, that there are other elements in the alloy than copper, tin, lead and zinc. Where these came from, it would be hard to state without knowing exactly the procedure. It is possible that they were poured at widely different temperatures, although you are convinced that the pyrometer reading was reasonably close. Possibly your pyrometers were not in perfect order. It is generally conceded that 85-5-5-5 alloy or alloys of that similar nature having a little more or less lead, possibly a little more or less tin or zinc, are sensitive to the pouring temperature, and the effect of this change in pouring temperature is to influence the soundness and malleability, provided all other conditions are kept up to a proper standard.

Fracture No. 2 would indicate gas absorption in excess of that indicated by sample No. 1. This would happen if it took longer time to melt No. 2 than No. 1. It might be possible that the crucible in which No. 2 was melted had been used previously for melting something else, thereby allowing the metal to absorb other elements. It may have been that the crucible was raised to such a high temperature that in the presence of charcoal the silicates in the binder were broken down chemically so as to release the silicon which was absorbed by the alloy.

Reader's Comment

Interesting communications from readers of The Foundry

EDITOR'S NOTE — *Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Much Gained

TO THE EDITORS:

As I have been quite close to the general gray iron foundry situation in Connecticut, perhaps you would be interested in the attitude of our foundry executives even though this information will now be too late for the purpose you desired. It is the desire of every foundry I have contacted to maintain present wages and hours until we know more definitely the plans of the administration and, regardless of some sort of an extension of NRA or not, I believe the foundries will continue to maintain wages but as business volume increases there will be an extension of hours to a nine-hour day.

In regard to the effect upon trade practices, I think that much that has been gained due to closer association at local meetings of the industry will be maintained. As a matter of fact, the gray iron foundry code did not offer protection against low prices. The requirement that selling prices be justified by costs based on the standard foundry cost system did not permit of easy check-up of costs and, in the case of manufacturing foundries doing some jobbing work, it would have been a highly complicated matter to show that costs were improperly figured.

One favorable result of the fair trade practice provision in our code was that it enabled us to spread the use of the simplified cost system much farther than this had been done by the old gray iron institute. The round table discussions of the cost system at meetings of our local chapters have invariably brought out accusations against competitors and once such accusations were thrown on the table for general discussion, the results have been a clearer understanding of each other's problems and, in many cases, the accusations of selling below cost were shown to be untrue due to better methods of foundry practice. I believe that the co-operative spirit which has been built up during the past months will result in general adherence to better trade practices and in more equitable competitive methods than existed prior to operations under the code.

H. S. WASHBURN,
Plainville Casting Co.,
Plainville, Conn.

Local Groups

TO THE EDITORS:

The gray iron foundry industry as covered by the code included practically all iron castings ranging from sash weights to the most intricate casting, and covering castings made for a vast range of usages.

The gray iron foundry business is more or less localized, particularly in straight jobbing work. The jobbing shops in the state of New Jersey have no particular interest in the jobbing shops in Chicago or Texas. The foundry making sash weights in New Jersey has no particular interest in the foundry making very intricate castings in Jersey. So that, when we break the foundry industry down, we find that it is as complex as the various industries to which they furnish castings. The methods of doing business is highly competitive due to the fact that almost anyone with a small capital of $5000 could start in the foundry business, or at least thinks he could.

With the help of NRA, which really provided the means for funds, some little has been accomplished in the gray iron industry. The two important accomplishments have been: First, the organization of local foundry groups throughout the country in an endeavor for them to associate and solve their problems; Second, the adoption of a more-or-less uniform costing system by a considerable number of foundries.

Unless it is possible to evolve some immediate method of continuing the work, particularly of organization and cost education in this highly competitive business, we will surely see renewed activities in price cutting, wage reductions, increased hours, and disregard to fair trade practices, and a reversal to the same conditions that existed before NRA.

To preserve the betterments we have accomplished during NRA and make any further improvement is going to be a great task and can only be accomplished by the stronger foundries who were grouped under the code to continue in an association and to immediately subscribe such funds as are necessary to carry this association through this particular period, and for this association, instead of thinking too nationally, to organize locally and by various classifications, leaving the local and classified individual organization be the controlling factor, and the national organization simply being a means for organizing the smaller groups.

GRAY IRON FOUNDRYMAN.

Need Associations

TO THE EDITORS:

In my opinion it is rather difficult to offer constructive thought at this time as to the future of the industry in which I am engaged.

I make this statement for the reason that I feel it is wise for us first to determine the next move of the administration in connection with a modified NRA before we go too far in formulating plans for the future.

Under the present conditions, however, I feel that the hours and wages which prevailed under the code will continue to be recognized, especially by the larger foundries; of course, the smaller foundries, many of which have always been in the category of chiselers, in my opinion will immediately increase hours and reduce wages. On the other hand, I feel all foundries will take advantage of the privilege they now have of working certain of their men overtime where necessary. That is to say, over and above the 40 hours per week, for which I feel they will pay time and half time. It of course, will be of great assistance to the foundry industry to work a man overtime occasionally without laying them off to keep them within the 40-hour period.

I am sorry to say that in my opinion, I fear that trade practices will be more or less ignored, and of course, included in such will be the trade practice which formerly prohibited the sale of our product below cost. I do not believe that this will be recognized. Consequently, I feel prices will have a greater tendency to drop than they will to increase.

I further feel that virtually the only avenue our industry has for co-operative enlightened competition among casting manufacturers will be that through the industry's associations, which in steel is the Steel Founders' society, in the gray iron could be the Gray Iron Founders' society, and in nonferrous, the Nonferrous Foundry association. Of course, the by-laws of these associations necessarily have to be changed to permit of an expansion of the association, its responsibilities and duties.

EASTERN FOUNDRYMAN.

James Thomson

Charles Wegelin

A. J. Murphy

Men of Industry

Whose Activities Are Making Foundry History

James Thomson (see page 38), recently elected chairman of the Chicago chapter, American Foundrymen's association, has been chief plant engineer of the Continental Roll & Steel Foundry Co., East Chicago, Ind., since 1930. Born in Scotland in 1881, Mr. Thomson came to the United States when 11. After attending Pittsburgh public schools and Washington & Jefferson college he joined the American Steel & Wire Co. at Pittsburgh, doing plant engineering work. Later affiliations included the Lewis Foundry & Machine Co. in a consulting capacity, the S. V. Huber Co. and the Ft. Pitt Engineering & Construction Co., all of Pittsburgh. For 10 years prior to 1916 Mr. Thomson was associated with the United Engineering & Foundry Co., Pittsburgh, in plant engineering work. In 1916 he joined the Hubbard Steel Foundry Co., East Chicago, Ind., as plant engineer, and in 1930, on the formation of the Continental Roll & Steel Foundry Co., was made chief plant engineer of that organization.

H. C. Sturman recently has been placed in charge of sales of the material handling division, Richards-Wilcox Mfg. Co., Aurora, Ill. Mr. Sturman formerly was connected with H. D. Conkey & Co., Chicago, and the American Engineering Co., Philadelphia.

Burnett J. Abbott has been elected president, Gale Mfg. Co., Albion Mich., succeeding H. L. Stanton.

E. V. Neeb has been made service engineer, Eaton-Erb Foundry Co., with offices in Detroit and plant at Vassar, Mich.

Frank J. Tone, president, Carborundum Co., Niagara Falls, N. Y., was awarded the degree of doctor of science by the University of Pittsburgh on June 5.

John G. Barry, senior vice president, General Electric Co., Schenectady, N. Y., has retired after more than 45 years of service and has been elected honorary vice president.

Don D. Smith, formerly vice president and general sales manager, Richmond Radiator Co., New York, has been appointed director of sales of the plumbing ware division Briggs Mfg. Co., Detroit.

O. W. McMullan, formerly chief metallurgist, Timken-Detroit Axle Co., Detroit, and prior to that connected with the Studebaker Corp., has been added to the research staff of the International Nickel Co. and will be located in the research laboratory at Bayonne, N. J.

James H. Lansing, formerly connected with the Grand Rapids Malleable Iron Works, Grand Rapids, Mich., and previous to that with the Danville Malleable Iron Co., Danville, Ill., has become connected with the foundry division of the Kelsey-Hayes Wheel Corp., Detroit.

Harold L. Geiger, formerly chief metallurgist Wisconsin Steel Co., a subsidiary of the International Harvester Co., and previous to that connected with the operating and metallurgical departments of the Inland Steel Co., has become connected with the field staff of the development and

research department, International Nickel Co., New York.

T. J. BRADY, formerly with the Accurate Tool Co., Detroit, will handle sales of grinding wheels in the Detroit district for the mechanical goods division, U. S. Rubber Products Inc., New York. At one time Mr. Brady was production superintendent, Wilson Foundry & Machine Co., Pontiac, Mich.

E. D. WACKER has been made assistant general sales manager, C. J. Tagliabue Mfg. Co., Brooklyn. Mr. Wacker has been connected with that company for 11 years, part of the time as manager of the Pittsburgh territory, and more recently as division sales manager.

CHARLES W. DANIELS has been appointed general sales manager by the Harnischfeger Corp., Milwaukee. Mr. Daniels has been connected with that organization for many years in various capacities, and most recently was in charge of the corporation's Philadelphia office.

GEORGE BATTY recently has resigned his connection with the Crucible Steel Casting Co., Lansdowne, Pa., and will engage in consulting work for foundries and users of steel castings. In 1927 and 1928 Mr. Batty was engaged in consulting work in Detroit, and following that was director of the Steel Castings Development bureau, Philadelphia.

WILLIAM L. NEWLANDS, formerly superintendent of No. 2 foundry, American Engineering Co., Philadelphia, and the Walker Machine & Foundry Corp., Roanoke, Va., has been appointed plant superintendent of the Spring City Foundry & Machine Co., Spring City, Pa. After leaving technical school in Scotland and serving his apprenticeship, Mr. Newlands worked as a molder on marine work, iron, brass steel castings. He came to the United States in 1912 and since that time has been connected with several plants making a wide variety of work.

CHARLES WEGELIN (see page 38) is president and treasurer, Dixie Bronze Co., Birmingham, Ala. Mr. Wegelin was born in South Pittsburg, Tenn., in 1877 and served his apprenticeship as a patternmaker at the Howard Harrison Iron Works, now the United States Pipe & Foundry Co., Bessemer, Ala. Later he became foreman patternmaker for the Bessemer Foundry & Machine Co., Bessemer. Following that connection he held the same position with the Sheffield Cast Iron Pipe Co., Sheffield, Ala., and the American Cast Iron Pipe Co., Birmingham. During his service for the latter company, he advanced to foundry superintendent and chief engineer.

He then became foreman and part owner of the Oakland Pattern Works, Pontiac, Mich. Some time later he returned to the South as foreman patternmaker for the United States Pipe & Foundry Co., Birmingham and Bessemer. Leaving that position he became president and general manager, Bruce Pattern & Mfg. Co., Birmingham and later vice president and general manager of Dixie Brass & Foundry Co., Birmingham. He has been president and treasurer of that company since Jan. 1, 1931.

A. J. MURPHY, chief metallurgist, J. Stone & Co. Ltd., engineers and founders, Deptford, London, will present the annual exchange paper of the Institute of British Foundrymen before the annual convention of the American Foundrymen's association in Toronto, Aug. 20-23. The paper will deal with high strength bronzes.

Mr. Murphy is a graduate with first class honors of the University of Manchester, and received the degree of master of science from that institution in 1920. Later, he was appointed research assistant to Prof. C. A. Edwards, University college, Swansea, University of Wales. From 1922 to 1931 Mr. Murphy was scientific assistant, metallurgical department of the National Physical Laboratory. In 1931 he resigned to accept his present position.

He is the author of numerous papers presented before the Royal society, Royal Microscopical society, Institute of Metals and the Institution of Mechanical Engineers. The papers have covered a wide variety of research work on copper-aluminum-nickel alloys, copper-phosphorus, alloys of silver, amalgams, metallography at low temperatures, wrought iron, iron chains, cracking of boiler parts and bearing metals.

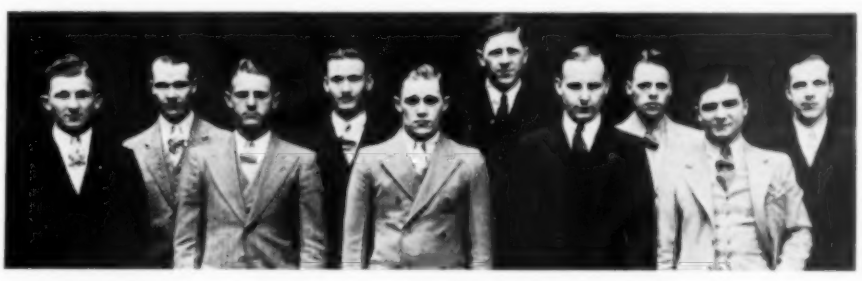
Cleveland Trade School Awards Diplomas

Ten young men, the first graduating class of the foundry division of the Cleveland Trade school, received their diplomas at a luncheon held at Hotel Statler, Cleveland, Tuesday, June 11, and attended by public and trade school officials and local foundrymen.

The event marked an important milestone in the training of foundry workers in Cleveland under the direction of the board of education and in co-operation with the Associated Industries of Cleveland and a committee of local foundrymen. Several years ago the need for such training was presented to the board of education. After a careful study of the situation, the plan was approved, a special addition to house the foundry department was built by the board at the trade school on Eagle avenue, and was equipped by the foundry and equipment and supply interests. The school was dedicated Dec. 6, 1929.

All of the first class have been employed, the following young men having been placed in the plants listed: Theodore Stabkowski, Earl Reimers and Victor Urzycki, the Forest City Foundries Co.; John Sobezynski, the Grabler Mfg. Co.; Herbert Reinmann and Anthony Dusa, the West Steel Casting Co.; Anthony Cameli and August Bajorek, the U. S. Aluminum Co.; William Davies, the Wellman Bronze & Aluminum Co.; and Wilbur Kelch, the Atlas Foundry Co.

Walter L. Seelbach, Forest City Foundries Co., and one of the original committee assisting in the establishment of the school, presided at the graduation exercises, and the diplomas were presented by H. A. Bathrick, assistant superintendent of schools. Short talks were made by James G. Goldie, foundry instructor; M. D. Jones, principal of the trade school; William Frew Long, Associated Industries of Cleveland; John Firtz, supervisor of vocational education; Frank Cech, instructor in patternmaking and Charles F. Beeler, Art-in-Bronze Foundry. Anthony Cameli responded for the boys.



Graduating class in the foundry department of the Cleveland Trade school. Front row, left to right—Theodore Stabkowski, John Sobezynski, Herbert Reinmann, Earl Reimers, Anthony Cameli. Back row, left to right—William Kelch, Victor Urzycki, August Bajorek, William Davies, Anthony Dusa

Gray Iron Founders Adopt Program

Industry meeting at Cincinnati plans work of society following NRA Ruling

DETERMINATION to preserve co-ordination and co-operative action which had been stimulated by NIRA was expressed by almost 100 gray iron jobbing foundry owners convened at Cincinnati, June 6 and 7. This general industry meeting, scheduled a number of months previously, quickly was revamped by its officers to meet the new conditions resulting from the Supreme Court decision which invalidated the gray iron industry code.

In the keynote address by the president of the Gray Iron Founders' society, Franklin R. Hoadley, Farrel-Birmingham Co., Inc., Ansonia, Conn. the point was emphasized that more than 1800 jobbing foundries, representing 73,000 employes with 300,000 dependents comprised the industry. He cited the dependence of these people as a great responsibility which can be fulfilled only through collective activity and the development of a system not based upon a compulsory procedure which had been found to curtail production, increase costs, and magnify sales resistance for the gray iron industry. He pointed to the favorable outlook which is based upon the cessation of immigration, broadened markets, the delayed replacement of obsolete equipment, low interest rates and improved understanding of basic business principles.

Organization Is Needed

James W. Hook, Geometric Tool Co., New Haven, Conn., the luncheon speaker on Thursday, drew a broad general picture of the problems left on industry's doorstep by the collapse of NRA. Mr. Hook, who is vice chairman of the durable goods industries committee and has served through a great part of the life of NIRA as a member of the industrial advisory board in Washington, stressed the need of organizing industry if its voice and influence are to have any affect on the new social and legislative thought of a people moved by the trials of 5 years of depression.

He urged that manufacturers join to accomplish the basic concept of NIRA through spreading employment, maintaining wage rates, outlawing child labor and observing those trade practices which are just and fair. The recognition of a maximum hour *ceiling*, a compromise of industry, was held by the speaker to have been a greater loss than any point surrendered in the bargaining which constituted code formulation. Price fixing is out for a long time to come. The tendency of labor legislation has a definite trend toward a federalized control distasteful even more to the workman than management. If business improves over the next few critical months, the speaker stated that the recent experience with NRA gradually would be forgotten. However, if there is a substantial slump congress again may attempt federal control and supervision over the industrial system.

A complete and detailed review of the executive staff of the gray iron code authority was presented by Henry M. Halsted Jr., executive vice president. He offered a summary of 13 points dealing with the activities of the office staff of 18 persons, ranging from compilation of statistics, preparing briefs on code definitions and procedure, to the preparation and distribution of reports, letters, bulletins, processed and dictated letters reaching the staggering total of 101,270 letters or more than 351,000 sheets of paper within the period of one year. He defined the industry as composed of 1847 companies doing an annual business of more than 114 million dollars in 1934. Tonnage increased 39 per cent and sales volume 44 per cent in 1934 over 1933.

The report of the treasurer, R. D. Phelps, Francis & Nygren Foundry Co., Chicago, was read by Mr. Halsted. This showed that with a budget of $107,923 for the first 11 months of code administration, a total of $94,847 has been assessed, $85,418 collected and $64,600 disbursed, leaving a surplus for that period. For the second period the budget was $128,120 and with only two quarters assessed totaling about $39,000, payments had been made establishing a surplus of $6,600. In opening the sessions, President Hoadley outlined the action of the code authority which cancelled items of expense, including many of the features of the projected Cincinnati meeting, the reduction of the staff to four persons, and other steps in retrenchment. The existing obligations are to be liquidated as quickly as possible and a pro-rata refund made to members of the industry.

C. B. Magrath, North Western Foundry Co., Chicago, vice president of the society and the code authority, strongly urged the members to preserve the gains made through industry co-operation. He stated that a definite need exists to find means of discouraging competitive price cutting, of carrying on cost education, establishing fair trade practices, eliminating waste and exerting some activity to represent industry politically.

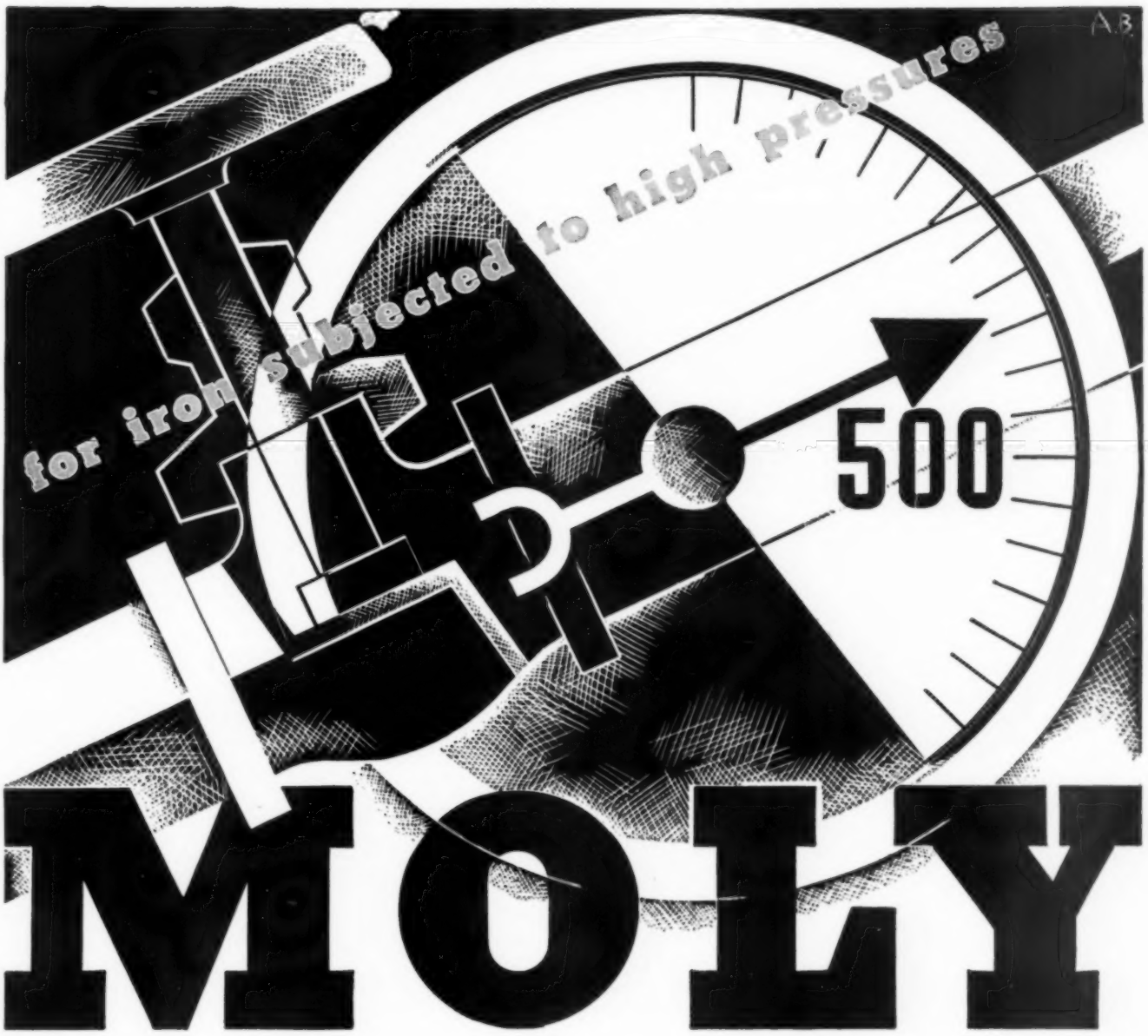
Committees Appointed

Following a discussion of the proposal that the industry continue to function through a trade association participated in by members from the floor, the chairman was requested to appoint two committees to report to the Friday morning session. These were as follows:

On proposed activities; Walter L. Seelbach, chairman, Forest City Foundries, Inc. Cleveland; W. D. Bowdry, Dallas Foundry, Inc., Dallas, Tex.; George Branston Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.; A. W. Lemme, Elizabeth Street Foundry Co., Chicago; Frank M. Robbins, Ross-Meehan Foundries; Chattanooga, Tenn.; A. C. Ziebell, Universal Foundry Co., Oshkosh, Wis.; and J. T. Smith, North Jersey Foundry Co., Little Falls, N. J.

On methods of financing; H. P. Hubbell, Semi-Steel Casting Co., St. Louis; R. E. Kucher, Olympic Foundry, Seattle, Wash.; H. S. Washburn, Plainville Casting Co., Plainville, Conn.; A. C. Denison, Fulton Foundry & Machine Co., Cleveland; J. H. Pohlman, Pohlman Foundry, Inc., Buffalo; W. J. Grede, Liberty

(*Concluded on page* 42)



ADVANCING civilization has ever demanded inventions and mechanical improvements to meet its faster economic pace and higher industrial standards. Greater speed — in transportation and in production — has put heavier strains on machinery . . . which in turn, have put higher pressures and other stresses on the irons and steels going into their construction.

For example, more and more is being demanded of such iron castings as Diesel and gasoline engine liners, valves, cylinder blocks, condenser heads, etc. *The most economical and efficient of all methods for meeting the increasingly stringent specifications is by resorting to a Molybdenum-alloyed gray iron.*

Example: A concern producing cast iron steam valves had been using an alloy iron (with no "Moly") which passed the 250 lbs. test against leakage, but almost invariably permitted leaks at 350 lbs. They changed the alloy content to .45% Moly and .25% Chrome — cutting their alloy cost from .62c per pound to .45c per pound — *and the valves did not leak even at 500 lbs. pressure.*

Moly is gaining more and more the reputation as the outstanding alloy element of the age. Keep up to date with the developments that are constantly making progress . . . let us put you on the mailing list of our periodical news sheet, "*The Moly Matrix.*" And, while you are sending us your name and address for this purpose, your further request for these two books will be gladly complied with: "*Molybdenum in* 1934" and "*Molybdenum in Cast Iron* — 1934 *Supplement.*" Still further, if you've an alloy problem that's hard to solve — either from an economy or an efficiency standpoint — our metallurgists and Detroit laboratories are at your disposal. Climax Molybdenum Company, 500 Fifth Avenue, New York City. (In Canada: Railway & Power Engineering Corp., Ltd.)

CLIMAX Mo-lyb-den-um

(*Concluded from page 40*)

Foundry Inc., Wauwatosa, Wis., and with Don McDaniel, Decatur Casting Co., Decatur, Ind. as chairman.

The afternoon sessions were devoted to a variety of addresses, including the following; "Chapter Activities," by Frank W. Carter, Fillmore Foundry, Inc., Buffalo; "Costs," by John L. Carter, Gray Iron Founders Society, and P. E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, O.; "Silicosis," by W. H. Winters, American Brake Shoe & Foundry Co., New York; and "Sales of Castings by the Price vs. Average Pound Price," by W. H. Hoppenjans, Star Foundry Co., Covington, Ky.

Completing the unfiished program of the gray iron industry meeting on Friday, June 7, A. C. Ziebell discussed apprentice training, stressing the need for an estabiished program and suggesting this as a function of local chapters. B. G. Parker, Youngstown Foundry & Machine Co., Youngstown, O., advised a three months probation period before a boy is admitted to apprenticeship, then the payment at once of common labor wages, with an automatic raise every three months during the entire period of apprenticeship.

Walter L. Seelbach, speaking on specifications, gave a resume of the development of gray iron castings specifications, including the work of the Gray Iron institute committee in co-operation with the American Society for testing materials.

Committees Make Reports

The Gray Iron Founders' society session then was called to order by President Hoadley who asked for the presentation of the reports of committees appointed at the industry meeting Thursday. Walter L. Seelbach, chairman, offered as suggestions from the committee on activities a program as follows: 1—Advising and representing the industry in relation to national legislation. 2—Extending the work on cost and estimating systems. 3—Sales promotion, including establishing trade practices. 4—Specifications. 5—Compiling statistics on wages and hours. 6—Collecting and disseminating technical information. 7—Collecting business statistics. 8—Accident, compensation and safety work. 9—Apprentice training. 10—Extending uses of gray iron castings. 11—Co-operation with other organizations and associations.

Don McDaniel, chairman of the committee on finances, presented suggestions covering the establishment of dues, and offered a plan inviting members to permit their previously collected code assessments to be applied against their dues in the society.

New directors chosen by the nominating committee were unanimously elected. These are as follows;

Ronald E. Kucher, manager, Olympic Foundry, Seattle, for Washington, Oregon, Idaho, Montana; A. C. Muff, manager and treasurer, Commercial Iron Works, Los Angeles, for California, Utah, Arizona Nevada; A. C. Ziebell, secretary, Universal Foundry Co., Oshkosh, Wis., for Minnesota, North Dakota, South Dakota, Wyoming, Wisconsin; H. P. Hubbell, president, Semi-Steel Casting Co., St. Louis, for Colorado, New Mexico, Kansas, Missouri, Southern Illinois; C. B. Magrath, president, North Western Foundry Co., Chicago, and J. H. Diedrich, general manager, Blackhawk Foundry & Machine Co., Davenport, Iowa, for Iowa, Northern Illinois, Northern Indiana, Nebraska; Geo. D. Branston, assistant treasurer, Campbell-Wyant & Cannon Foundry Co., Muskegon, Mich., for Michigan; Walter L. Seelbach, secretary-treasurer, Forest City Foundries Co., Cleveland, for Northern Ohio; A. H. Kramer, president, Advance Foundry Co., Dayton, O., for Southern Indiana, Southern Ohio, Kentucky; W. H. Winters, vice president, American Brake Shoe & Foundry Co., New York, for Western Pennsylvania, W. Va., Garrett and Allegheny Counties in Maryland; N. H. Schwenk, president, Cramp Brass & Iron Foundries, Philadelphia, for Eastern Pennsylvania, So. New Jersey, Delaware, District of Columbia, Maryland except Garrett and Allegheny Counties; J. H. Pohlman, vice president, Pohlman Foundry Co., Buffalo, for Western New York, Erie County in Pennsylvania; A. B. Root Jr., assistant general manager, Hunt-Spiller Mfg. Corp., Boston, for Massachusetts, Rhode Island, Maine, New Hampshire, Vermont; Frank R. Hoadley, vice president, Farrel-Brimingham Co. Inc., Ansonia, for Connecticut, Eastern New York; W. H. Cole, president, Moore Bros. Co., Elizabeth, N. J., for Northern New Jersey, Northeastern Pa.; E. C. Graham, manager, Acme Foundry & Machine Co., Blackwell, Okla., for Texas, Oklahoma, Arkansas, Louisiana; George J. Golden, superintendent, Golden Foundry Co., Columbus, Ga. for Mississippi, Alabama, Tennessee, Georgia, Florida, North Carolina, South Carolina, Virginia.

Officers Are Elected

The board of directors elected the following officers: President C. B. Magrath; vice president, R. E. Kucher; secretary, W. H. Cole; treasurer, W. L. Seelbach.

Industry Decides to Carry on Work of Malleable Founders' Society

FOLLOWING a meeting of the board of directors of the Malleable Founders' society, two general industry meetings recently were called at which 90 per cent of the total number of malleable foundries were represented and their composite total tonnage was 95 per cent of the volume of malleable castings produced annually.

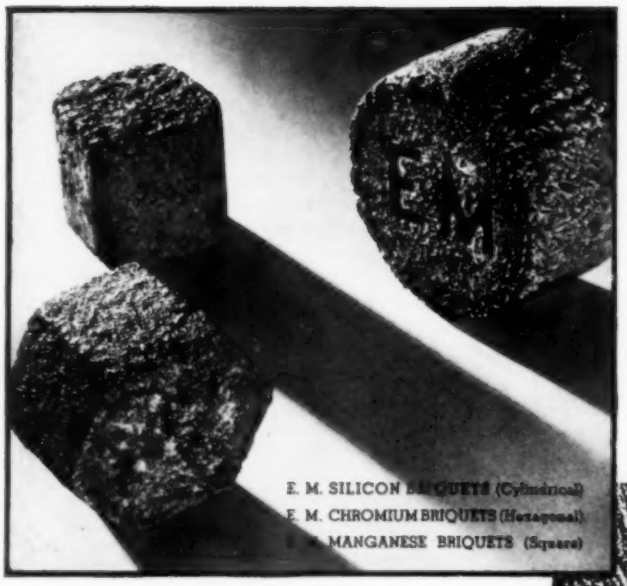
The first of these meetings was held in Chicago, Wednesday, June 12 and the second in New York on Thursday, June 13. Their purpose was to determine whether the industry wished to continue the society in the furtherance of co-operative action in the industry. It was decided unanimously that the society should be carried on, that it should maintain a field service devoted to inspection of member plants in matters relating to labor, promoting the use of uniform costs and investigating any variations from established recognized trade practices. Resolutions were adopted voicing the sentiment of the society that individual members of the industry acting voluntarily during the present uncertainty should maintain the rates of pay, hours of labor and standards of competition which were set forth in the malleable industry code.

It was decided that all features of the code should be maintained with the exception that the schedule of fair and reasonable costs of production in the industry should be discontinued. Further, individual foundries, if they wish, may publish or file individual prices on such malleable products as may be subject to sale on a price list basis.

Continue Monthly Reports

It was the sentiment of both meetings that the 40 hour week should be recognized but that this might be averaged to permit an excess of 32 hours in each 6 months calendar period when peak requirements require such deviation, but in this case the maximum week should be 48 hours.

Individual employers will continue to report monthly wage and hour standards classified by individuals and character of employment. Further, a check will be made of complaints arising from alleged trade practice violations and educational work will be conducted in improvement of cost prices.



Briquetted Alloys *are convenient*

BRIQUETTED alloys provide a simple and convenient method of adding ferro-alloys to cupola charges. In the briquetted form, alloys are easy to handle. Correct additions are readily calculated and made.

E. M. Briquets are of specific sizes and contain exact weights of the alloying elements. It is necessary merely to count out the correct number of briquets and add them to the charge. Weighing is eliminated. Uniformity and flexibility of control are obtained.

E. M. Briquets are protected from oxidation by a refractory binder until they reach the melting zone of the cupola. Thus a high recovery (better than 90 per cent) of the alloying element is obtained and off-iron is avoided. Iron of uniform physical and chemical composition is the result.

Let Electromet Engineers show you how you can use E. M. Briquets to your advantage. Write today for complete information.

PRODUCTS OF A UNIT OF UCC UNION CARBIDE AND CARBON CORPORATION

ELECTRO METALLURGICAL COMPANY
Unit of Union Carbide and Carbon Corporation

UCC

CARBIDE and CARBON BUILDING
30 EAST 42nd STREET • NEW YORK, N. Y.

Electromet
Ferro-Alloys & Metals

Fig. 7—After the runner box is rammed full of sand it is scraped off flat and covered with a plate

Melts Iron in Air Furnace

(*Continued from page 20*)

this by two to decide the depth of chill which will appear in the roll. The second group observes a change in the physical structure or a change in the direction of the crystals, a point about half way to the first mottle. Either of these features is impossible to describe and cannot be seen with certainty by any person lacking considerable actual operating experience. The second method, practiced at the Mackintosh-Hemphill foundry, is considered the more accurate.

Through long experience the first test usually shows that the iron has the desired composition. Where the depth of chill corresponds to what should be present with iron of that analysis, and slightly less than desired, the bath is stirred again. A second test then is taken. The second poling reduces the silicon, manganese and carbon to some extent and thus increases the depth of chill to appear in the roll.

Iron Ore Added

If the preliminary test shows that the chill is too light to be increased by poling, other methods may be adopted. The silicon, manganese and carbon may be reduced by small addition of iron ore, or by the addition of from 1 to 2 per cent white iron. Chill depth also may be increased by raising the sulphur content. Where iron pyrites is used, 40 per cent of the sulphur contained usually is obtained. Where only a trifling increase of chill is desired the pyrites may be added in the stream flowing into the ladle.

Where the preliminary test shows that the chill is too deep, it may be reduced by furnace addition of high silicon pig iron, ferrosilicon or ferromanganese, depending on which element is low as shown by the analysis. Slight changes may be effected by adding ferrosilicon, or ferromanganese or both to the stream in the spout.

When the chill depth, temperature and composition of the iron meet the desired points, the metal is tapped into a ladle suspended in a pit. Long curved spouts from adjoining furnaces are arranged to deliver metal from two furnaces simultaneously—when necessary—into a single ladle. The slag is skimmed from the top and the metal is held in the ladle until it approaches the proper casting temperature. For sheet and tin mill rolls this is between 2425 and 2435 degrees Fahr., as determined by an optical pyrometer.

Roll castings always are poured in a vertical position. Chilled rolls and plain rolls are molded in an upright position, while grooved rolls are molded horizontally, but in both cases the molds are assembled vertically and poured in that position. The sprue or runner for a chilled roll is made separately and attached to the outside of the mold where the opening in the curved bottom coincides with a similar opening or gate in the flask below the chill. Runners and gates vary with the size of the casting. For example, the runner on a 10,000 pound casting is 4 inches in diameter. The gate entering the neck of the mold in the drag is reduced to about 2½-inches diameter or to an oval 1 x 3 inches. The gate enters the neck about 6 inches below the fillet and is set at a tangent so that the metal acquires a whirlpool motion as it rises in the mold. This whirling motion has a tendency to hold any dross or foreign material in the center where eventually it is carried up into the riser or sink head. The lateral movement also prevents the formation of wrinkles on the surface of the casting in contact with the chill. On exceptionally long rolls a ring gate is used with four small tangential gates leading into the drag neck. Except in unusual instances the wabblers top and bottom are cast to size. The customary finish is allowed on the necks. The usual contraction is provided on all parts of the pattern except the upper neck. This part is molded approximately ½-inch short, since this part of the casting lengthens or stretches to that extent.

Chill Thickness Varies

Heavy cast iron chills form the walls of the mold. The thickness of the chills vary according to the size of the roll. They are machined on the inside to the diameter of the roll plus the contraction, plus finish on the roll. For example, for a 28-inch roll the chill is bored to 28⅞-inches. In some instances the chills are located on top of each other by pins in lugs on the outside. In others they are located by shallow concentric male and female joints. Where an existing chill is longer than the body required on the roll, part of the upper neck is molded in sand inside the chill.

Roll chills are cleaned with a wire brush or sandblast the day before they are needed. Then they are heated in an oven to approximately 400

(*Concluded on page 47*)

Air Furnace Charge for Chilled Iron Rolls

Scrap	Serial No.	Per Cent	Silicon	Sulphur	Phosphorus	Manganese	Carbon
Roll	5763	36	0.66	0.088	0.444	0.27	3.00
Roll	3833	20	0.63	0.071	0.324	0.25	3.08
Head	7058	7	0.75	0.083	0.426	0.28	3.01
Gates	.....	2	0.68	0.085	0.425	0.27	3.00
Pig Iron	Car No.						
A	52607	5	2.10	0.022	0.360	0.85	3.88
B	53438	10	1.58	0.030	0.150	0.63	3.98
C	64278	8	1.31	0.022	0.160	0.45	3.65
D	280994	2	0.17	0.015	0.156	0.19	3.55
A	26202	10	1.29	0.022	0.500	0.42	3.70
		100	0.929	0.061	0.363	0.359	3.27
Additions charged		.....	.....	0.010	0.085	0.041	.....
Total charged		.....	0.929	0.071	0.448	0.400	3.27
1st test, chill 9/16"		.....	0.74	0.072	0.	0.28	3.00
2nd test, chill 5/8"		.....	0.74	0.072	.....	0.29	3.00
Ladle addition 13½ lbs. pyrites		.....	.....	0.020	.....	.....	.....
Final analysis		.....	0.73	0.091	0.431	0.28	3.00

Chill on rolls 7/8" clear—1 5/8" total.

ADVERTISING PAGES REMOVED

(*Concluded from page* 44)

degrees Fahr. On the following morning they are again cleaned and blacked while hot either with a brush or pneumatic spray. The blacking material is made up of pulverized beehive coke 90 per cent and clay 10 per cent. This is mixed with molasses water to the consistency of thin cream and allowed to stand a day before it is used.

A machined iron plate on the floor supports the pattern for the neck and wabbler. The pattern is centered on this plate and suitable guides on the edge locate the flask concentric with the pattern. Each ramming plate may be used under several size patterns and flasks. A strong natural loam sand is employed in these sections of the mold. After the mold section is removed from the plate, it is rolled over, finished, blacked and placed in the oven. On the following day the molds are assembled either on the floor or in pits, depending on the total height. Up to the present the heaviest roll measured 44 inches diameter and weighed 88,000 pounds. This involved a furnace charge of 110,000 pounds.

In pouring a roll, a small stream is allowed to flow until the metal has risen to a point a few inches above the gate in the neck. The ladle then is tipped rapidly to fill the pouring basin and keep it filled until the metal shows up well in the cope neck. Pouring from the ladle then is stopped, since there is enough metal in the pouring basin to force the metal in the roll upward into the sink head for a distance of several inches. Later the sink head is filled from the top to the desired depth. Depending on the size, the roll is allowed to remain in the mold for from 24 to 72 hours. Then it is shaken out, cleaned and taken to the roll turning shop.

Sand rolls in which the passes are roughly outlined are molded horizontally by sweeps in the type of flask shown in Fig. 4. Guide boards bolted to each end of the flask support the spindle which is turned by a crank handle. In the illustration the projections on the face of the sweep form grooves for the reception of cast iron condensing rings. Each ring is in four parts or quadrants of a circle, two in the cope and two in the drag. They are supported by the sand strip at the joint of the flask and by wires attached to staples in the rings and then drawn through holes in the flask and anchored on the outside. Metal thickness of the condensing rings varies according to the composition of the roll and the purpose for which it is intended.

Alloy iron rolls are grouped under two classifications: 1—Those with a true chilled iron structure including (a) molybdenum chill (b) nickel-low chromium-standard phosphorus (c) nickel-chromium-molybdenum, and 2—Those with a grain roll structure showing no distinct line of demarcation between the primary chill face and the gray iron of the body center. The phosphorus usually is low and the chromium over 0.80 per cent. They include (d) molybdenum-chrome (e) nickel-chrome (f) manganese-chrome (g) nickel-molybdenum-chrome (h) high nickel 4-5 per cent, high chrome 2-2.5 per cent. These are all proprietary rolls covered by patents.

This is the second of four articles covering activities in plants of the Mackintosh-Hemphill Co., Pittsburgh. The third dealing with steel foundry practice will appear in an early issue.

Book Review

Transactions of the American Foundrymen's association, cloth, 772 pages, published by the American Foundrymen's association, Chicago, and supplied to members for $2.00 and to nonmembers for $8.00.

This volume contains a summary of proceedings of the thirty-eighth annual meeting of the association, held in Philadelphia Oct. 22-26, 1934; a report of the Fifth International Foundry congress, the minutes of the annual business meeting and of the various meetings of the board of directors held throughout the year.

The greatest portion of the book is devoted to the technical papers presented at the Philadelphia meeting, together with the written and oral discussion which followed the various presentations. The technical papers include a symposium on "Porosity in Steel Castings," and one on "Testing Cast Iron."

Lists Standards On Refractory Materials

American Society for Testing Materials, 260 South Broad street, Philadephia, recently has published a book containing standards on refractory materials. In addition to all of the 21 specifications, test methods and definitions standardized by the A.S.T.M. through the works of its committee C-8 on refractories, the book includes a manual on interpretation of refractory test data, detailed information on the standard samples of type refractory materials, and reports of extensive industrial surveys showing the service conditions of refractories in outstanding consuming industries.

Copies may be secured from the society for $1 each.

Henry A. Petter Supply Co., Paducah, Ky., has been made distributor of the shovel and crane division, Link-Belt Co., Chicago.

Chicago Chapter Of A. F. A. Elects Officers

New officers and directors of the Chicago chapter of the American Foundrymen's association were elected at the last meeting of the season, held at the Medinah club, June 7. James Thomson, Continental Roll & Steel Foundry Co., East Chicago, Ind., and vice chairman of the chapter during the past year was elected chairman. L. J. Wise, Chicago Malleable Castings Co., was chosen vice chairman. W. C. Packard, National Engineering Co., and C. C. Kawin, Chas. C. Kawin Co., were re-elected secretary and treasurer, respectively.

Five directors were elected to fill vacancies and expired terms. These are: H. W. Johnson, Greenlee Foundry Co., G. B. Stantial, Illinois Malleable Iron Co. and C. B. Schneible, who were named for three-year terms, and D. J. Reese, Whiting Corp., and John Owen, Harbison-Walker Refractories Co., who will serve one and two years, respectively.

The program of the meeting included the showing of motion pictures prepared by the International Harvester Co. on "Commercial Uses of Industrial Tractors." Principal speaker of the evening was J. S. Vanick, metallurgist, International Nickel Co., New York, who discussed the hardening of cast iron.

Mr. Vanick's talk, which evoked considerable discussion, was presented with illustrations showing the effects of alloying and heat treatment on the grain structure of gray iron castings. Variations in hardness as a result of different additions of such alloys as nickel, chromium and molybdenum as well as the improvement attained in uniformity of hardness through casting sections, as in the bore of engine cylinders, were described.

Studies Need for Schedule of Tolerance

Absence of any standards of tolerances for dimensions of castings has led the gray iron division of the American Foundrymen's association to appoint a committee to investigate the desirability of developing schedules of tolerances and if there is a real need for such schedules to formulate porposals and to present them to the association for criticism and adoption.

A tentative proposal for gray iron castings size tolerances has been drawn up upon which the committee hopes to obtain suggestions from interested members of the foundry industry. The tentative proposal may be secured by addressing the American Foundrymen's association, 222 West Adams street, Chicago.

Gray Cast Iron *Chapter II (Concluded)*

(*Continued from page* 23)

right of the eutectic, hyper-eutectic cementite also may separate before solidification of the eutectic and in some cases it can be proved that it does. What then, is there to prevent the assumption that hyper-eutectic cementite first separates from hyper-eutectic alloys, and this hyper-eutectic cementite then decomposes, rejecting some of its carbon as kish? For if hyper-eutectic irons are quenched drastically from the liquid, hyper-eutectic cementite is found. Presence of manganese aids the retention of hyper-eutectic cementite. In this connection attention is called

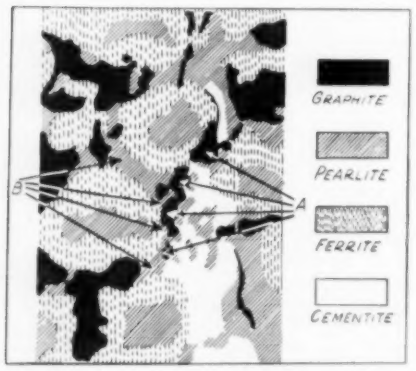


Fig. 54—Sketch illustrating island of ledeburite in stage of decomposition, according to Heike and May

to the carbon solubility diagrams of Ruff and Goecke, and of Hanemann shown in Fig. 53. These are self explanatory.

4—The occasional appearance of a fine, uniformly dispersed graphite distribution, somewhat like that shown in Fig. 32, THE FOUNDRY, May, 1935, page 28—has been considered by some as evidence of a graphite eutectic. However, the author has shown clearly that this so called graphite eutectic in many cases at least, is in reality a pseudo eutectic, a decomposition product of ledeburite—J. W. Bolton—THE FOUNDRY Aug. 15, 1923 and Oct. 1, 1927. Heike and May—*Die Giesserei*, July 12 and 19, 1929, pages 623-633 and 643-649—have arrived at a similar conclusion, namely that the so-called graphite eutectic seems to be a secondary product. They illustrate this in the sketch shown in Fig. 53, and illustrating an island of ledeburite which is in a stage of decomposition. Between solid solution areas, graphite (a) and pearlite (b) are present. This suggests that cementite separates first and graphite then forms as one of the decomposition products of the cementite.

Work by the author has indicated the following:

(a) Graphite flake groupings resemble in shape actual or potentially pre-existent cementite.

(b) On examining iron which is white, mottled and gray, across a given section of the transition zone, the mottled area clearly shows the formation of graphite usually at the boundaries of the cementite formations.

The author therefor gravely doubts the conclusion of Hanemann—*Stahl und Eisen*, 1931, pages 966-967—that graphite can separate directly from the melt. Like Hanemann, he has observed that the formation of a graphite flake within a ledeburite area, but in his experience this is the exception rather than the rule, and rarely if ever is observed in irons unless they are so close to the eutectic concentration that the possibility of hyper-eutectic segregation cannot be overlooked.

If graphite separated from hypo-eutectic and eutectic cast irons during solidification, great differences in composition would be expected due to the lightness of graphite relative to the iron. In general, such differences do not seem to have occurred. Hurst has claimed no such segregation is observed in centrifugal castings. However, Norbury and Rowley—*Bulletin* B.C.I.R.A., July 1, 1931, pages 7-9—have published some interesting results based on careful sampling of pig irons. These are shown in Fig. 55, and in data of the following table:

	Av. Carbon	Silicon	Phos.	Calc. Eut. Carbon*
No. 1.....	3.78	1.50	0.70	3.58†
No. 3.....	3.48	2.40	0.70	3.33†
No. 4.....	3.48	1.66	0.70	3.53‡
Cylinder	3.33	1.70	0.70	3.52§
Mottled	2.36	1.50	0.70	3.58§

*(4.3—0.3 Si.) × (100—10 P).
†Probable condition, hypereutectic.
‡Probable condition, close to eutectic.
§Probable condition, hypoeutectic.

It readily is seen that the carbon differences are greatest in irons of hypo-eutectic and close to eutectic composition (No. 1, 0.27 per cent; No. 3, 0.27 per cent; and No. 4, 0.25 per cent) less in the moderately hypo-eutectic iron (Cylinder, 0.13 per cent) and nil in the markedly hypo-eutectic iron (mottled).

Furthermore there is a great deal of discussion about fine and coarse flake structures. Metallographists would do well to give more consideration to flake groupings in attempts to elucidate the present question through microscopic study. The author has shown that in commercial irons certain of these fine flake groupings can, and often do assume coarse flake forms if time for flake growth is allowed.

As Hurst states "The mere fact that this structure (the so-called graphite eutectic) has the appearance of an eutectic structure is not sufficient evidence to conclude that the structure is a true eutectic. . . The possibility of obtaining structures very similar to the so-called graphite eutectic structures by heat treatment in the solid state, at once discounts the assumption that these structures are true eutectics, and coupled with the fact that quenching from temperatures round about the final solidification point, is invariably accompanied by the austenite-carbide eutectic we must admit that the weight of evidence is in favor of the fact that the carbon is dissolved in the liquid iron as the carbide and

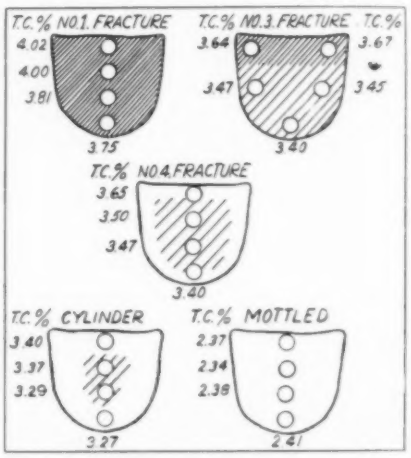


Fig. 55—Composition variation in pig iron, according to the British Cast Iron Research association

that the existence of the austenite-graphite eutectic is impossible."

5—Other matters must be referred to, even though briefly, before concluding this short discussion of the *double* diagram versus the *single* diagram.

The mechanism of graphitization often is indicated by the equation

$Fe_3C \rightarrow 3$ Fe plus C plus energy.
Cementite→iron plus graphite plus heat release.

This is the ultimate net reaction of cementite decomposition, but does not depict adequately the intermediate reactions. While the exact nature of these has been discussed by many writers, no one suggested explanation has received general acceptance.

The more probable reactions, under conditions approaching equilibrium, are:

1—$Fe_3C \rightarrow$C plus austenite and energy
2—Austenite then breaks down progressively.

The ultimate products of reactions 1 and 2 are ferrite and graphite.

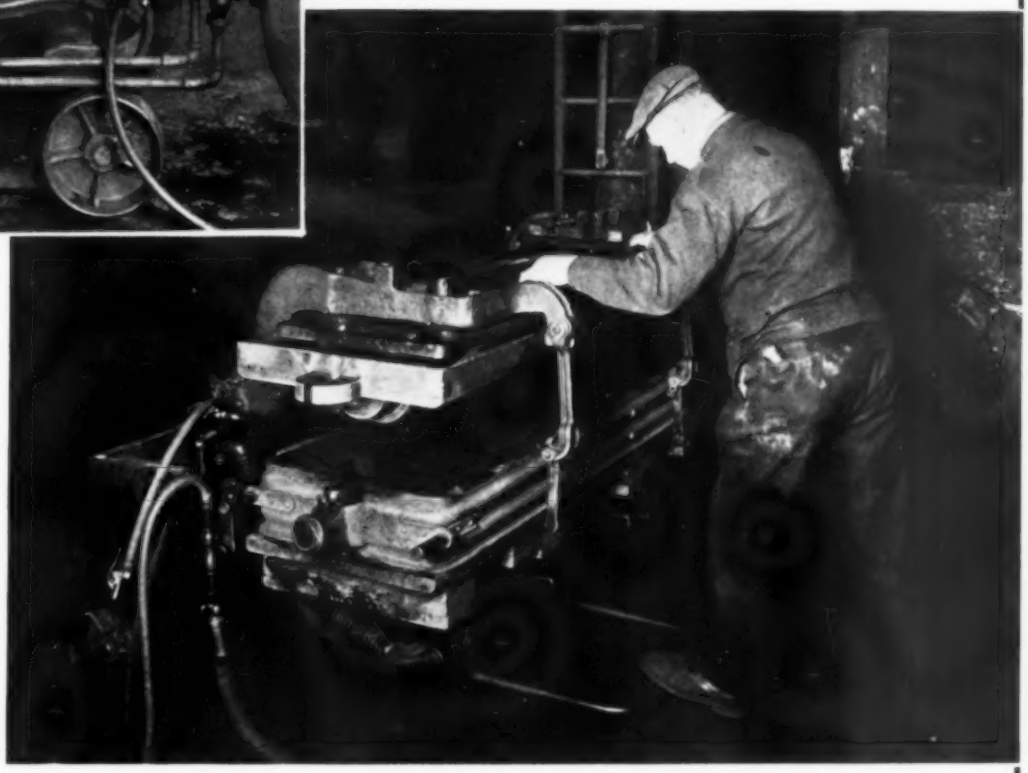
Among other explanations is that of Honda and Murakami—*Journal* Iron and Steel Institute, 1920, pages 287-294. They say—"As the temperature falls from the melting point a minute

(*Concluded on page* 50)

We build
—14—
Types of Machines
that have been designed especially for making
CORES

Type SB10 Core Blower

When you buy an
INTERNATIONAL
you are always sure to get the
RIGHT MACHINE FOR THE JOB
Our extensive line, developed during 30 years of experience, insures this



Type JD P Jar Ram Power Lift Machine

We build
—63—
Standard Types
and a vast number of
Special Types
of machines for molding
CASTINGS

Type G Jar Ram Power Turnover Foot Draw Machine

INTERNATIONAL MOLDING MACHINE CO.
2608-2624 W. 16th St. Chicago, Ill.

quantity of carbon dioxide coexisting with carbon monoxide soon reacts on cementite and produces carbon monoxide by the equation:

Fe_3C plus $CO_2 \rightarrow 2$ CO plus 3 Fe

This diminution or disappearance of carbon dioxide causes a further dissociation of carbon monoxide by the equation:

$2\ CO \rightarrow CO_2$ plus C

This reproduces the dioxide, which reacts with cementite. Thus, these two reactions, being repeated continuously in the alloys, graphite gradually is produced with consumption of cementite. The gases carbon monoxide and carbon dioxide thus act somewhat as catalyzers, according to Honda and Murakami.

6—Carbon in solid solution in the austenite apparently is present in atomic form, in the lattice interspace of the gamma iron. This is true whether or not the austenitic carbon has been obtained through solution of cementite or graphite.

The line *SE*, Fig. 46, THE FOUNDRY, June, 1935, represents the limit of this solid solubility of carbon in austenite. It should be noted that in case of steels and apparently also in cast irons, the carbon from supersaturated austenite evidently first forms iron carbide, or cementite upon rejection. Hence the line *SE* is called the A-Cm line, representing the solubility of cementite in austenite—even though the cementite evidently is not dissolved as such! The exact placement of this line remains a matter of dispute, as experimental methods are considered inadequate. Harder and Johnson—A.S.S.T. *Transactions*, 1929, pages 49-68, and others have shown that this solid solubility is affected markedly by presence of oxygen and it undoubtedly is influenced by other factors also.

A *double* diagram as published in the monograph—*Alloys of Iron and Carbon*, is shown in Fig. 52.

The authors of Alloys of Iron and Carbon state "For greater simplicity the iron carbon alloys might be explained solely on the basis of the iron cementite (meta-stable system) diagram, omitting the iron-carbon (stable system). The fact of graphitization might then be covered by the statement that cementite is unstable at high temperatures and at high carbon concentrations. . . Graphite, formed from the decomposition of cementite, has a lower solubility in austenite than has cementite."

This view is held by the present author. Admitting the whole *double* diagram as an interesting hypothesis and the Acm-Agr lines as proved, he feels that satisfactory experimental proof of initial graphitization according to the stable system remains to be given. The implications of the possibility are far reaching and if proved, should lead to major developments in gray iron technology.

It is hoped that this brief and cursory review of certain features of the iron carbon diagram, or diagrams, will enable the reader to grasp at least a panoramic picture of this fascinating and important subject. The author wishes to emphasize that what is known about the iron carbon diagram has been a fruitful source of metallurgical advancement—not only theoretically interesting but also intensely practical. Knowledge of this system, imperfect though it may be, has brought about transformation of the art of the blacksmith to the science of modern heat treater. It has been of great assistance to the manufacturers of malleable iron, of steel castings, and of wrought steel products. It has suggested the methods utilized in production of highest grade gray irons. It is most interesting to read publications of pioneers like Howe and Sauveur, who, from their early knowledge of this diagram, were able to predict accurately subsequent practical developments. Since great practical advances have been made as a result of knowledge of this diagram, is it too much to hope that elucidation of now obscure and disputed points may lead to striking progress in the future? We think not.

Acknowledgment

THE author wishes to acknowledge gratefully the assistance of a number of able authorities in reviewing and checking certain chapters of the book "Gray Cast Iron" which have appeared, or will be presented shortly in The Foundry. Sections on structure and effects of common elements were reviewed by Dr. C. H. Lorig, and the chapter on iron and carbon by Samuel Epstein, both of Battelle Memorial institute, Columbus. The chapter on alloys was reviewed carefully by J. S. Vanick, International Nickel Co., New York. The chapters on phosphorus were reviewed by Y. A. Dyer, Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., and those on mechanical properties by H. Bornstein of Deere & Co., Moline, Ill., and Ralph S. MacPherran, Allis - Chalmers Mfg., Milwaukee.

British Meeting

The autumn meeting of the British Iron & Steel Institute will be held in Manchester, by invitation of the iron and steel trades, heavy engineers and kindred trades of Manchester and District, from Sept. 16-18, 1935.

Book Review

Penton's Foundry List, bound loose leaf, fabricoid cover, published by the Penton Publishing Co., Cleveland and supplied by THE FOUNDRY, Cleveland for $50.

This complete directory of gray iron, steel, malleable, brass, aluminum, permanent mold and die casting foundries in the United States and Canada has been completely revised and brought up to date in this edition, the first published in 5 years. In compiling and checking the information contained in this edition, complete facilities of the field organization of the Penton Publishing Co. have been used, the co-operation of financial and business groups, and chambers of commerce has been secured, and foundry equipment and supply producers have contributed freely.

Each listing gives the name and address of the company, the type of metal melted and the number, capacityp and type of melting units. A code key is used in supplying this information to facilitate ready reference. The information is carried on looseleaf pages 6 x 9 inches, printed in typewriter type, with the listings arranged geographically by towns and states.

Some idea of the completeness of the work is seen in the fact that the list contains the names of 3580 gray iron, 343 steel, 159 malleable, 2860 nonferrous, 86 permanent mold, and 92 die casting foundries. In addition, it lists 3356 patternshops and 3398 machine shops.

For many years *Penton's Foundry List* has been maintained as a service to those doing business with the foundry industry. It is the only list of its kind available and provides the one complete and comprehensive measure of the foundry industry in the United States and Canada.

Pig Iron Production Gains in 1934

Production of pig iron in 1934, according to a statistical bulletin of the American Iron & Steel institute, New York, was 15,676,889 tons as compared with 13,000,719 tons in 1933. Total merchant iron in 1934 was 2,663,714 tons.

The total pig iron production was divided into the following classifications: Basic pig iron, 10,101,744 tons; bessemer and low phosphorus pig iron, 3,431,289 tons; foundry iron, 1,265,179 tons; and malleable iron, 827,151 tons.

Smith-Emery Co., industrial chemist and engineer, is celebrating the completion of its 25th year of continuous operation in Los Angeles. E. O. Slater is president of the company.

GRAIN SIZE CONTROL starts on the charging floor

THE strong, tough, dense-grained castings required for valve bodies, hydraulic work and pressure vessels cannot be made from an assortment of heterogeneous scrap. ■ Consistently good results with permissible percentages of loss in both foundry and machine shop can only be assured with consistently reliable charges. ■ Pure Charcoal Pig Iron permits higher cupola superheats necessary to the solution of the large graphic nuclei—a condition necessary to high strength castings. Furthermore, the slower cooling rate induced by Pure Charcoal Iron also minimizes the danger of incipient shrinkage cracks. ■ Use Pure Charcoal Pig Iron in every mix made up for castings which must be pressure-tight and strong.

Write for specific experience data from the files of our Metallurgical Department on that casting problem of yours that won't stay solved.

SUPERIOR CHARCOAL IRON COMPANY
GRAND RAPIDS, MICHIGAN

DEBEVOISE-ANDERSON CO., INC. • Eastern Representative
NEW YORK BOSTON PHILADELPHIA

Superior **PURE CHARCOAL PIG IRON**

Influence of Temperature

(*Continued from page* 29)

considerable trouble through defects which, while being repairable, were of considerable commercial significance. The casting is fairly simple, is of harmonious design and of almost uniform section thickness. Deficiencies in the casting were all in the lower levels, leaks at the fillets or radiused junction of flange with body, and at bolt holes on the bottom flange.

The orthodox method of heading and gating, which was used for the casting under discussion, is illustrated in Fig. 1. The mold was placed in a horizontal position on the pouring floor and the casting was poured *flat*. It should be noted that the upper ingate *D* is not a true step-gate and cannot exercise the devised function of promoting the selective flow of metal from the downgate into the upper levels of the casting. Without a breaker gate, devised to check the downward velocity of the cast metal, such an ingate as *D* cannot reasonably be expected to function properly.

Used Reversal Method

To overcome deficiencies apparent in castings made by the orthodox method—such deficiencies being attributable to the adverse temperature gradients in both mold and metal, and to the local hot spots at the lower ingates, promoting the formation of both external tears and mid-section cavity — the partial reversal method was used as described by the author—*Transactions*, A.F.A., 1934, and *Journal*, American Society of Naval Engineers, 1934. The method is indicated in Fig. 2 where the casting is shown in the pouring position, the mold being *banked* on a reversing block to an angle of 15 degrees. The block is of such a height or thickness as will permit of reversing the mold through an angle of 30 degrees, after pouring is completed, to produce an angle of rest of about 15 degrees.

As the gating and heading system, illustrated on Fig. 2, may be somewhat difficult to understand, an additional explanatory diagram is provided in Fig. 3. The vent *F* is taken from the crown of the blind feed head *E* to the mold joint and the vents *H*, *H*, *H*, are taken from the mold cavity at locations which are the high plane of the casting proper, in the pouring position. It is essential that these latter vents be adequate to permit the egress of the atmosphere of the mold cavity at such a rate as will avoid developing any serious back pressure which would oppose the inflowing metal. In ensuring such adequacy of aperture it is necessary to avoid a shape of section which may promote a defect in the casting.

Experience has shown that round vents, of sufficient diameter to evacuate the mold atmosphere at a proper rate, will frequently reveal an unsound spot — a fine pipe — in the casting when removed. Vents of rectangular section are greatly to be preferred and the thickness of such vents should not be greater than one-half the section upon which they are imposed. The thickness of the vents being prescribed by the casting, their width has to be determined in relation to the devised pouring rate to ensure that serious back pressure by mold atmosphere is not generated during pouring. Vent *F* is small, and may be of circular cross-section.

A comparison of the two methods of producing the casting illustrated on Figs. 1 and 2 may be made best by considering vertical sections of the casting, one for each method, comprising gate and head as well as casting. The casting as produced on the orthodox method is shown on Fig. 4.

Poured at the Bottom

Notwithstanding the provision of the stepgate *C*, it is affirmed that the casting, as shown on Fig. 4, would be almost entirely bottom poured, provided that metal temperature and pouring rate were such as to run the casting cleanly, without the formation of serious cold shuts or deeply penetrant ripples. In actual practice, metal was delivered at the downgate until a level was attained approximating the line *X-X* on Fig. 4. Pouring at the downgate ceased and feed metal delivered to the head by top pouring directly into the feeder. (Reverting to Fig. 1, and continuing to describe actual practice, it should be stated that riser *G* was the first to be top-

(*Continued on page* 55)

Exchange Paper

THIS interesting discussion by Mr. Batty represents the exchange paper of the American Foundrymen's association presented before the annual conference of the Institute of British Foundrymen held in Sheffield, England, July 2 to 5. The author is a consultant on steel castings problems with headquarters in Philadelphia.

It is planned to make this paper available for discussion at one of the steel sessions during the Toronto convention of the A.F.A., Aug. 20 to 23.

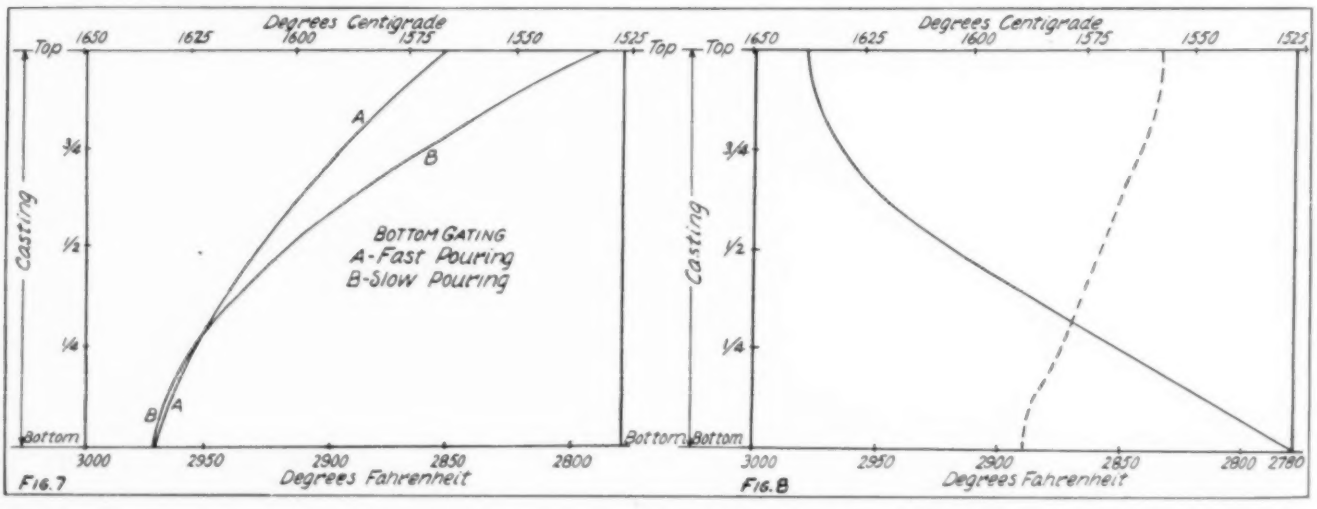


Fig. 7—Slow pouring rate will produce a poor temperature gradient. Fig. 8—Hypothetical temperature gradient for example shown in Fig. 5. Solid line sloping downward from left to right indicating substantial feeding potentially by superimposed riser. Broken line same casting bottom gated at light section

ADVERTISING PAGES REMOVED

(*Continued from page 52*)

filled, pouring continuing until either the head was filled, or, if metal was flowing to the other risers, until a quantity had been delivered to *G* approximately equal to twice its capacity. Thereafter, metal was added, in turn, to each riser or feed head until all were filled. However, as a general rule the metal was so cool at *G*, *H*, and *H*1, that *G* could be completely top filled without promoting any rise of metal-level in the other feed heads.)

Most British foundrymen are likely to be acquainted with Brearley's graphic representation of the freezing of an ingot, inscribed lines approximately parallel to the mold faces being used to indicate the progress of the formation of the continuously thickening solid envelope. The casting under discussion, Fig. 4, might be considered as a poorly designed ingot, parallel sided, and much too great in length — height, as poured — in relation to its diameter or section thickness. Added to this, we have the disadvantages to be associated with bottom pouring. This system of gating could not be entirely avoided as the castings were necessarily produced in green-sand molds.

Bottom-gating of a casting inevitably produces an adverse temperature gradient in the metal, the top of the casting being coolest and the bottom being hottest at the moment the mold proper is filled. The amount of this temperature difference, and the angle of the temperature gradient, are related to the pouring rate —rise of metal in mold per second —and to the heat-conductivity of the mold. A slow pouring rate will produce a poor temperature gradient, as compared with that produced by fast pouring, when the gradient is indicated in the manner illustrated on Fig. 7. As the gradient line more closely approaches the vertical, for bottom poured castings, the more favorable are the conditions for producing soundness by superimposed feed heads.

Indicates General Trend

It is not suggested that the gradient lines shown on Fig. 7 accurately represent the metal temperature at the different levels of the casting, but the diagram is used to indicate the general trend of one effect of bottom pouring.

Transfer of heat from the metal to the mold is the prime reason for the notable difference in temperature existent between the upper and the lower metal in the mold and it is reasonable to believe that such transference of heat is, to some considerable degree, related to the duration of contact of metal with mold in the act of pouring. It therefore follows that the lower levels of the mold, closely adjacent to the ingate, are considerably heated and delay the solidification of the metal. Hot spots, so generated, produced two types of defects on the casting under survey, Fig. 4:

1. External hot tears at the radius *D*, and

2. Internal shrinkage cavities *E*.

All the castings of this type, produced on orthodox methods, Fig. 1, showed these defects at each of the three lower ingates and while external chilling at the radius eliminated or decreased the incidence of external hot tears, mid-section unsoundness persisted. Failure to deliver feed metal to the affected parts is believed to be a considerable factor in the combination of causes which promoted the defects.

In the revised system of production the castings were gated and headed, and were poured on what is called the partial reversal method, as indicated on Fig. 2. It should be noted this method prescribes, as essential to its efficacy, that the castings preferably be gated and headed at one end of the long axis, whereas the castings produced on the orthodox method were gated at the side, or parallel with the long axis. Green sand procedure had to be followed and the casting necessarily, was bottom gated to provide for the introduction of the metal in a quiet, non-turbulent manner.

Horn-gating into the bottom of a side, or elbow, riser has distinct advantages over either the straight or the tangential ingate. In the particular case under discussion it had the added advantage of overcoming one of the deficiencies of the ordinary blind riser in that the geyser effect of the ingate almost entirely prevented the accumulation of relatively cool metal within the blind head.

The angle of pouring prescribed that at least two-thirds of the casting would be produced by metal flowing through the lower ingate and the speed of pouring was accelerated steadily until it could be seen that metal was flowing through the upper gate. It is believed that, with the indicated gating system, metal ceases to flow through the lower gate almost immediately upon the commencement of delivery through the upper gate, and it therefore follows that the lower levels of metal quickly come to rest and can proceed with solidification while the upper levels of the mold are being filled.

The pouring rate must be such, as in the case of the castings made on ordinary methods, that serious cold shuts or ripples are avoided.

The gating and heading system used on the partial reversal method is indicated in Fig. 6. In comparing this with Fig. 4 it must be remembered that Fig. 6 shows the whole of the heading system whereas Fig. 4 showed only one of the six risers. The two feed heads used on the partial reversal method weighed a little less than half the total amount of head-metal used on the ordinary method.

The actual gate-aperture at the lower flange, as shown on Fig. 6 was 9 x 1¾ inches, which ensured the entry of the metal into the mold proper without serious turbulence. The blind head, disposed immediately above the horn type ingate functioned as a balancer to avoid surging within the mold cavity. In visualizing the flow of metal in the mold— remembering that the mold is inclined at an angle of 15 degrees, the ingate being the low point — it readily can be seen that distribution from a single large ingate must produce practically identical temperature gradients in the lower levels of the casting on each side of the long axis. Vertically, there is a local adverse temperature gradient for approximately two thirds of the height of the body end wall adjacent to the gating and heading system; but, as the upper gate begins to function this adverse temperature gradient in both metal and mold does not become acute.

Metal Enters Upper Gate

Approximately one third of the metal which forms the casting is delivered through the upper gate, the metal delivered by the lower gate tending to build up to an appreciable head within the mold above the lower ingate and balancing the pressure at the downgate. Without the breaker gate, the upper gate would be late in functioning and a considerably more acute adverse temperature gradient would be produced adjacent to, and above, the lower ingate.

The upper ingate is definitely a slot and is inclined upward to ensure a mild whirling or eddying motion of metal within the riser. This device is calculated to prevent the formation of a cool upper layer of metal within the riser as the upper levels of the casting are poured. If an ordinary flat ingate is used at the base of the upper head it is found that little eddying occurs in the riser while the upper levels of the mold are being filled. Consequently, when both mold and riser are filled — the top of the riser, in the case under discussion, being several inches higher than the high point of the casting at the other end of the mold — there may be several inches of relatively cool metal at the top of the riser, lying over the hotter metal in the lower part of the riser. This is a local adverse temperature gradient which can be avoided by using a slot gate.

The vents will seal themselves if they are of proper number, size and shape, and the mold may be reversed as soon as the ladle moves

away. The mold is located approximately in balance on the rocking blocks or bar and, the wedges being removed, may be reversed through an angle of about 30 degrees to produce an angle of rest of 15 degrees. Molds of considerable size may be manipulated but the larger molds, containing castings weighing upwards of 3000 pounds usually demand the services of a crane.

At the angle of rest the casting is in the feeding position where gravitation may amplify the effect of whatever favorable temperature gradient has been produced in pouring and reversing the angle of the mold. The adverse temperature gradient in the lower levels of the section shown on Fig. 6 is taken care of by the blind riser, which is placed in a superior position by the reversal of the mold, and by the favorable temperature gradient of the upper levels of the casting plus the superimposed feed head.

This casting taken, as an example for discussion at such length and in such detail, is not one which presents potentialities for the production of a perfect temperature gradient in both mold and metal but it does present an opportunity for the citation of the successful application of the temperature gradient theory whereby controlled directional solidification was attained and commercially sound castings produced in a foundry which theretofore had experienced some considerable trouble and loss in making such pieces.

Method Not Successful

It might be argued that if the heading and gating system used on the partial reversal method had been employed along with orthodox pouring on the flat, the temperature gradients requisite to the production of a sound structure would have been secured without the trouble of reversing the mold. Such an argument seems cogent, but it can be stated that the argument was advanced and the method tried. It was not entirely successful, and it was demonstrated that without the reversal method larger feed heads were required. Even with these larger heads the body wall section adjacent to, and above, the lower ingate was not as sound as when the reversal method was used.

In steel foundry practice the most favorable temperature gradient in both metal and mold may be attained by a system of operation that has been called "the total reversal method." Within limitations prescribed by the available equipment this method is productive of definite economies on certain types of castings, and at the same time promotes a degree of integral soundness of structure unattainable by ordinary methods.

The example chosen for description is a liner of the design shown in Fig. 5. Normally, such a casting—which has to be machined all over and must also be of uniform internal soundness — would have to be made pronouncedly tapered in section, tapering from heavy section at the top to light section at the bottom. Such a provision would, in turn, demand additional expense in machining off the excess metal.

The casting, as shown in Fig. 5, is a hollow cylinder having almost uniform wall thickness from collar to end. The feed head is annular in form and the gating system is produced in two cores. The upper core, in the pouring position, provides ten ingates while the lower core contains the annular distributor gate which is connected to the base of the downgate by a double cross gate. The downgate is either tile (stopper sleeves may be used) or is made of special cores. A solid pattern, with feed head pattern and the print for the gate cores firmly attached, makes practicable the very simple one-part molding method.

After the pattern is drawn, the mold cleaned, center core inserted and the gate cores positioned—these acting as centralizing cores for the center core—a base plate is clamped on firmly and the mold turned over into the pouring position as shown on Fig. 5. As the mold is to be completely reversed after pouring it is necessary to affix a cover plate or board. This must be provided with holes or slots to allow free venting of the mold atmosphere.

The pouring operation — predicated by experience — applies metal as hot as practicable and a pouring rate as slow as practicable. These provisions produce in metal and mold the greatest practicable temperature gradient which, after the mold is reversed through an angle of 180 degrees, bringing the head into its proper position to deliver feed metal, presents a metallurgical picture akin to that of a tapered ingot — big end up — in a well designed ingot mold provided with a hot-top or brick head.

With the casting in the reversed position after pouring, the lower levels of the metal are cool and are in contact with cool mold while the upper levels, particularly in the head, will be maintained in a fluid condition for a considerable length of time by reason of the heat of the mold with which they are in contact. In constructing a diagram to indicate the progress of solidification for such a casting in such a mold, using Brearley's method of inscribed lines, the lines would not be drawn parallel with the mold faces but would, rather, incline toward each other as in an elongated V.

Fig. 8 presents as a full line a hypothetical temperature gradient for the example under discussion, the line sloping downward from left to right, such inclination being indicative of substantial feeding potentiality by the superimposed riser. The broken line on the same figure is a hypothetical temperature gradient for the same casting bottom gated at the light section, with the collar or flange and the feed head at the top. In attempting to produce such a casting in such a manner it is to be assumed that a fairly rapid pouring rate would be ensured and that the metal temperature would not be unduly high.

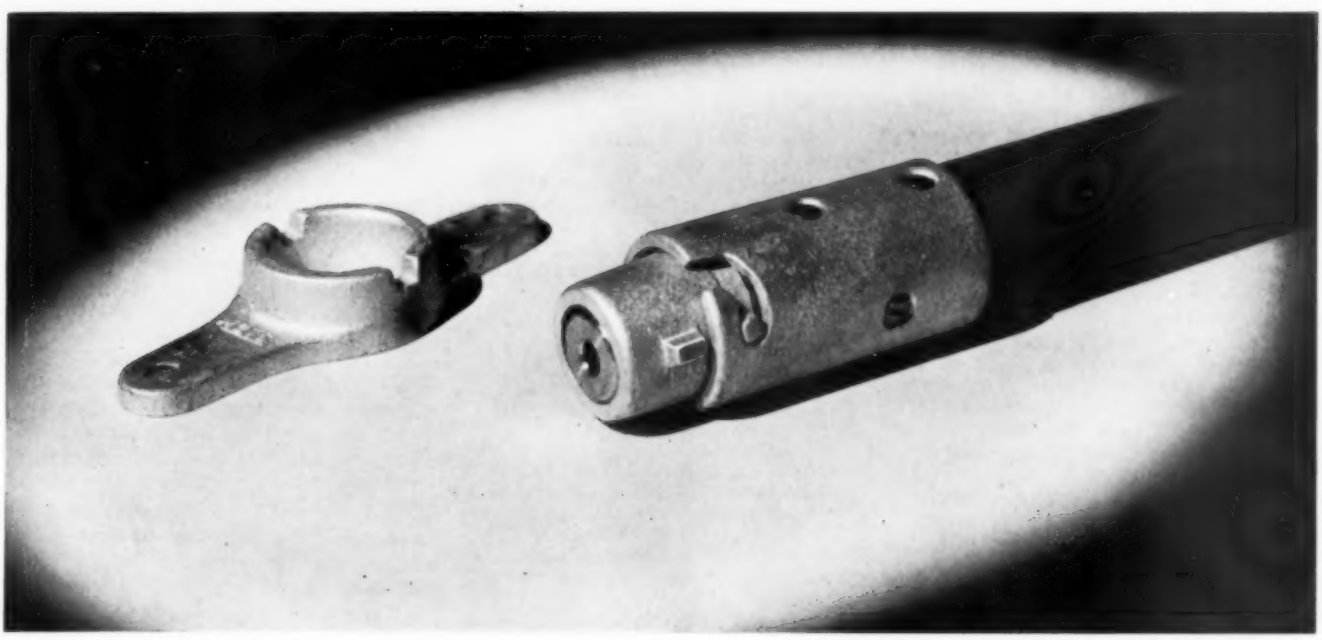
Admittedly Fig. 8 is conjectural, but the suggested gradients are based upon observation of the pouring of many castings and the examination of a number of castings which have been bled, either intentionally or fortuitously. In scrutinizing the temperature gradients it is not to be assumed that anything but an average for the section is intended to be expressed. It is recognized that a temperature gradient exists from surface to midsection and, in a horizontal direction, from gate to parts remote from the gate in castings which are poured *on the flat*.

Sand Absorbs Heat

The temperature gradient of the mold — really a relatively thin envelope of mold surrounding the casting — is much more difficult to visualize. Briggs and Gezelius have shown that throughout a considerable part of the cooling of a cast 6-inch diameter sphere the temperature of the sand at a distance of ⅛-inch from the mold-metal interface was only about 150 degrees Fahr. less than the temperature at the center of the sphere. Despite the low thermal conductivity of sand, the mold takes a considerable amount of heat from the metal in transit, as is demonstrated by castings accidentally bled as the result of a break-out near the gate. Such remnant shells show an envelope of considerably greater thickness formed at the upper levels than at the lower levels close to the ingate, and demonstrate the potency of the mold as a coolant in relation to pouring temperature, pouring rate and section.

It is obvious that the potency of the mold as a cooling agent decreases sharply as section thickness increases but the potency of the mold increases as the distance to be traversed by metal within the mold increases. Thus, the temperature gradient which can be created in a cast 6-inch cube, suitably headed, is slight as compared with that attainable in a cast piece 6 x 6 x 72 inches long produced on the partial reversal method.

This is the first of two articles on the subject by Mr. Batty. The concluding section will appear in an early issue.



Why You Will Like
Norbide Pressure Blast Nozzles

1. They give more service per dollar cost than any nozzle now available —750 hours when used with silica sand, 1500 hours when used with steel grit or shot.
2. They decrease air consumption from 10% to 20% as compared with iron nozzles.
3. They maintain a stream contour and abrasive velocity that improves blasting efficiency.

All three features of Norbide Nozzles are due to their exceptional resistance to wear—to the fact that their lining material is Norton Boron Carbide, the hardest material ever made by man for commercial use.

NORTON COMPANY
Worcester, Mass.

Distributors for
Norbide Nozzles

PANGBORN CORPORATION
Hagerstown, Md.
RUEMELIN MFG. CO.
Milwaukee, Wis.
THE W. W. SLY MFG. CO
Cleveland, Ohio
THE MAC LEOD CO.
Cincinnati, Ohio

On hand hose operated machines use Outside Bayonet Type Hose fittings (illustrated above) with Norbide Pressure Blast Nozzles. They are recommended for the following reasons—(a) light and easy to apply; (b) not subject to wear and will last indefinitely; (c) protect the nozzle from abuse; (d) permit the nozzle to be removed with ease for inspection of the gasket and in case of clogging.

A bulletin giving complete information on the sizes and prices of Norbide Nozzles sent on request—no obligation.

N-16

1885 - Fiftieth Norton Year - 1935

NORTON COMPANY
NORTON ABRASIVES
BEHR-MANNING
NORTON-PIKE

A. F. A. Convention at Toronto

(*Concluded from page* 31)

8 p.m. to 10 p.m.—*Industrial Health Hazards and Employer Responsibility*
Dr. Wm. J. McConnell, Assistant Medical Director and Director, Industrial Health Section, Metropolitan Life Insurance Co., New York.
Donald L. Cummings, Assistant Director, Saranac Laboratories, Saranac, N. Y.

8 p.m. to 9 p.m.—*Cast Iron Shop Course* (Session 2)
"Relation of the Air Charge to Cupola Operation," by H. V. Crawford, General Electric Co., Schenectady, N. Y.

8 p.m. to 9 p.m.—*Sand Shop Course* (Session 2)
"Foundry Sand Problems Where Natural Sands Are Used."
Discussion Leader—Horace Deane, John Deere Co., Moline, Ill.

Thursday, Aug. 22

9 a.m. to 10 a.m.—*Sand Shop Course* (Session 3)
"Synthetic Sands"
Discussion Leader—R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston.

10 a.m. to 11 a.m.—*Cast Iron Shop Course* (Session 3)
"Adding Ferro-Alloys in the Cupola," by E. K. Smith and H. C. Aufderhaar, Electro Metallurgical Co., Chicago.

9 a.m. to 11 a.m.—*Apprentice Training*
"Fifteen years of Foundry Apprenticeship at the Falk Corp.," by Victor Hydar, Director of Personnel, Falk Corp., Milwaukee.
"Some Suggestions for Startiing and Carrying Out a Foundry Apprenticeship System,' by J. E. Goss, Employment Manager, Brown & Sharpe Mfg. Co., Providence, R. I.

9 a.m. to 11 a.m.—*Nonferrous*
Third Annual Conference on Deoxidation and Degasification of Nonferrous Metals.
Annual Business Meeting, Nonferrous Division.

11 a.m. to 1 p.m.—*Steel*
"Contraction and Solidification of Steel for Castings, III—The Rate of Skin Formation,' by C. W. Briggs and R. A. Gezelius, Naval Research Laboratory, Aanacostia, D. C.
Report of Committee on Impact Tests.
Report of Committee on Chemical Classification of Steels for Castings.
Report of Committee on Specifications.

11 a.m. to 1 p.m.—*Cast iron*
Centrifugal Casting Symposium:
"Production of Centrifugal Gray Iron Castings in Water Cooled Molds," by H. W. Stuart, U. S. Pipe and Foundry Co., Burlington, N. J.
"Slush Pump Piston Cores by the Centrifugal Process," by A. E. Falk, D & M Machine Co., Torrance, Calif.
"Cast Iron Pipe Centrifugally Cast in Sand," by J. T. MacKenzie, American Cast Iron Pipe Co., Birmngham, Ala.
"Centrifugal Castings," by J. E. Hurst, Sheepbridge Stokes Centrifugal Casting Co., Chesterfield, England.

1:15 p.m. to 3:45 p.m.—*Round Table Luncheon Conferences:*
Steel—Chairman, A. W. Gregg, Farrel Cheek Steel Foundry Co., Sandusky, O.
Malleable Cast Iron—Chairman, P. C. DeBruyne, Moline Malleable Iron Co., St. Charles, Ill.
Nonferrous—Chairman, H. J. Roast, Canadian Bronze Co. Ltd., Montreal.
Cast Iron—Chairman, W. H. Spencer, Sealed Power Corp., Muskegon, Mich.

4 p.m.—*Annual Business Meeting.*

7 p.m.—*Annual Dinner.*

Friday, Aug. 23

9 a.m. to 11 a.m.—*Steel Founding*
"Utilization of X-Rays in the Correction of Foundry Practice and for the Proper Control of Welding of Castings," by Mr. Underwood and E. J. Ash, Naval Gun Factory, Washington.
"Temperature Gradients," by George Batty, Philadelphia.

9 a.m. to 11 a.m.—*Cast Iron*
"Report of International Committee on Tests," by W. H. Spencer, Sealed Power Corp., Muskegon, Mich.
"Wear Resistance of White Cast Iron," by O. W. Ellis, J. R. Gordon and G. S. Farnham, Ontario Research Foundation, Toronto.

11 a.m. to 1 p.m.—*Dust Control and Safety Codes*
"Dust Collection Equipment," by S. D. Moxley, American Cast Iron Pipe Co., Birmingham, Ala.
Report on Safety Codes of American Standards Association.

11 a.m. to 1 p.m.—*Nonferrous*
"Founding of Magnesium Alloys," by Dr. J. A. Gann, Dow Chemical Co., Midland, Mich.
"High Strength Nonferous Casting Alloys," by A. J. Murphy, J. Stone & Co. Ltd., Deptford, London. (Exchange paper submitted on behalf of the Institute of British Foundrymen.)
"Report of Committee on Analysis of Defects," by H. M. St. John, Detroit Lubricator Co., Detroit.

Afternoon—*Canadian National Exposition.*

Convention visitors who remain for the exhibition will find the Canadian National exhibition exceedingly entertaining and instructive, and in all probability different from any previously attended. Year by year, the fame of the exhibition as the world's greatest annual exposition has grown. Because of its success, citizens of Canada are proud of this world famous achievement which this year is celebrating its fifty-seventh anniversary.

The Canadian National exhibition, with an investment of more than $21,000,000 in land, permanent buildings and plant equipment, is located in a magnificent lake front park in downtown Toronto,—an immaculate expanse of 350 acres with 10 miles of paved boulevards, exquisite horticulture and imposing buildings.

British and foreign governments and many private organizations have found this exposition not only the gateway to the Canadian market, but a world-wide trade stimulant. Visitors can enjoy a great variety of entertainment features—pageantry on a tremendous scale with the performers on the world's largest stage before a grandstand seating 25,000 people; music of foreign lands; two art galleries; aquatic spectacles; sporting events, and a mile-long midway.

Folder on Toronto

AN INTERESTING folder on Toronto, scene of the 1935 convention of the American Foundrymen's association, may be obtained free by addressing the Toronto Convention and Tourist Association, Inc., Hotel Waverly, Toronto, Ont. This booklet presents data and illustrations of points of interest in the city, and includes a map of the Great Lakes region indicating the main roads leading to Toronto.

Holds Discussion On Defective Castings

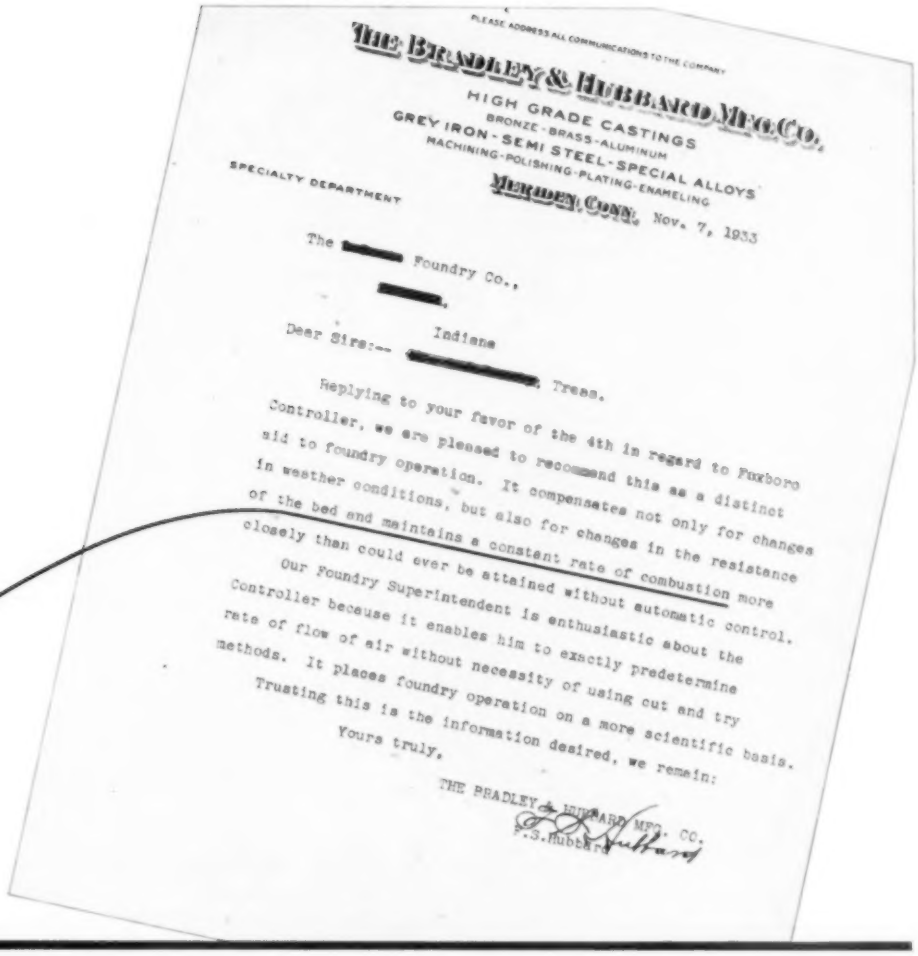
A round table discussion on "Defective Castings" featured the regular meeting of the New England Foundrymen's association held June 12 at the Engineers club, Boston. Discussion leaders included R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston, and Henry Jensen, General Electric Co., Lynn, Mass. Mr. Harrington treated the subject from the standpoint of defective castings where the iron was the deciding factor and Mr. Jensen considered the topic from the standpoint of other foundry defects.

A. B. Root Jr., Hunt-Spiller Mfg. Corp., discussed briefly the conclusion of affairs of the code authority of the gray iron foundry industry, explaining the actions taken at the recent industry meeting in Cincinnati.

George W. Thornburg, president of the association, announced that no meeting will be held in July but that an outing is being planned for August.

Moves Offices

Ferdinand G. Schultz recently has moved his office from the Park building, Pittsburgh to 215 Questend avenue, Mt. Lebanon, a suburb of Pittsburgh. Mr. Schultz represents the American Foundry Equipment Co., Cleveland Quarries Co., Milwaukee Foundry Equipment Co., Ottawa Silica Co. in the Pittsburgh territory.



PLEASE ADDRESS ALL COMMUNICATIONS TO THE COMPANY

THE BRADLEY & HUBBARD MFG. CO.

HIGH GRADE CASTINGS
BRONZE - BRASS - ALUMINUM
GREY IRON - SEMI STEEL - SPECIAL ALLOYS
MACHINING - POLISHING - PLATING - ENAMELING

SPECIALTY DEPARTMENT

MERIDEN, CONN., Nov. 7, 1933

The [redacted] Foundry Co.,
[redacted],
Indiana

Dear Sirs:— [redacted] Treas.

Replying to your favor of the 4th in regard to Foxboro Controller, we are pleased to recommend this as a distinct aid to foundry operation. It compensates not only for changes in weather conditions, but also for changes in the resistance of the bed and maintains a constant rate of combustion more closely than could ever be attained without automatic control.

Our Foundry Superintendent is enthusiastic about the Controller because it enables him to exactly predetermine rate of flow of air without necessity of using cut and try methods. It places foundry operation on a more scientific basis.

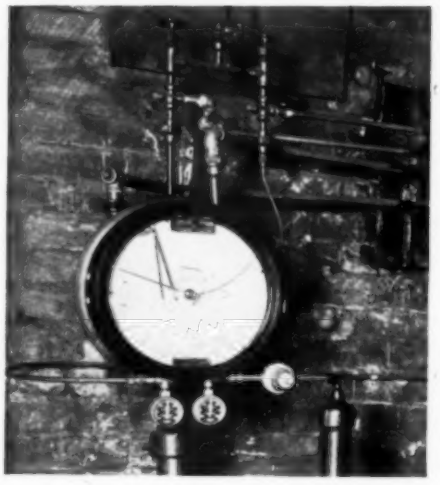
Trusting this is the information desired, we remain:

Yours truly,

THE BRADLEY & HUBBARD MFG. CO.

F. S. Hubbard

"maintains a constant rate of combustion"



The foundry to which this letter was addressed had written to five fellow-foundrymen, asking them "What's been your experience with Foxboro Cupola Air Weight Controllers?" The above letter is typical of all the replies they received—*every user* of the Foxboro Cupola Controller reported they had found it a profitable investment.

Why not find out how this Control fits into your particular conditions? You'll find—as other foundry operators have found—that it will give you better, more uniform castings, elimination of "burnt" iron, longer life for cupola linings, and a saving in power consumption.

If you have not received your copy of Folder 610—or if there is any specific information you need—write us. No obligation.

THE FOXBORO COMPANY

32 Neponset Ave. Foxboro, Mass., U. S. A.

Branches in 21 Principal Cities

CONTROL OF CORE-OVEN
TEMPERATURE CONTROL
OF PICKLING TANKS

FOXBORO
REG. U. S. PAT. OFF.

INDICATING, RECORDING
AND CONTROLLING
PYROMETERS, THERMOMETERS
FLOW METERS AND GAUGES

CUPOLA AIR WEIGHT CONTROLLER

Overcome Defects Through Study

(*Concluded from page* 33)

beautiful piece of music. In the application of the industrial conference type of training it always is suggested to use an extensive black board to record the entire proceedings or minutes of the conference so that the different ideas or facts which come up can be checked readily as the conference proceeds. The following is an example of the black board work of a conference showing the topic to be discussed, the aim and a record of the discussion for the first type of porosity.

TOPIC: POROSITY IN CASTINGS

AIMS: (a) How to recognize the cause of porosity in castings.

(b) To develop a procedure for the elimination of porosity in castings.

Define and clarify all terms and words in topic and aims before starting the discussion.

A. What are some of the types of porosity?

I. Small round holes on cope side of castings
II. Small round holes throughout the whole casting
III. Open structure or matrix
IV. Incipient shrinkage
V. Foam
VI. Irregular holes
VII. Cold Shuts
VIII. Segregation
IX. Internal shrinkage
X. Porosity in metal next to cores
XI. Nonmetallic inclusions
XII. Etc., etc.

B. What are some of the known causes for these types of porosity?

I. (a) Presence of oxides or other metals which form gas on cooling
(b) Metal vapors
(c) Gas absorption from melting operation which comes out in cooling
(d) Not enough liquid pressure
(e) When bronze alloy calls for high percentage of phosphorus such as ¾ to 1 per cent
(f) Molding sand and its preparation
(g) Trapped gases moisture or fumes.
(h) Gates which tend to agitate the metal in mold
(i) Gases formed by mold materials burning

II. (a) Metal poured too hot
(b) Presence of element or metal which is poisonous to the alloy in question
(c) Metal which has been burnt
(d) Etc., etc.

C. Suggested remedies for eliminating porosity

I. (a) Try using all new metal
(b) Use some kind of deoxidizing agent
(c) Use of a recommended flux
(d) Use of higher gate to obtain more liquid pressure
(e) Use of blind heads
(f) Moisture content should be about 7 per cent
(g) Clay content sintering point permeability and moisture characteristics should be checked
(h) Proper venting

II. (a) Proper pouring temperature can be determined by the use of a pyrometer
(b) Smelting and purifying methods must be used to clean metal.
(c) Reducing methods must be applied to the metal in the furnaces

Each of these items should be discussed thoroughly and if agreed upon, allowed to remain on the board. The success of the conference will be determined by the number of the group that participates and the amount of discussion evoked. In conclusion, it is the writer's opinion that if the industrial conference type of training is used in our plants or in co-operation with technical societies to blend engineering facts with shop practices, many troublesome problems can be worked out.

This article is from a paper presented at a recent meeting of the Pittsburgh Foundrymen's association.

Steel Founders Meet and Plan To Continue Association

COMPLETING a two day session of the Steel Founders' Society of America in Cleveland, June 18 and 19, members of the industry reaffirmed their determination to retain those features of NRA which proved beneficial both to employes and management. About 125 steel executives representing directly or indirectly over 90 per cent of the productive capacity of steel castings made slight changes in organization and structure necessary to continue as a trade association. The Steel Founders' society was the code formulating body and after the approval of the code on Nov. 2, 1933, was recognized and continued to function as the administrative agency. Its governing body consists of a board of directors representing eight districts that will continue to serve.

At the opening session, the sentiment of the industry was ascertained and the following resolution was adopted.

"Resolved that the representatives of the members of this industry here assembled pledge their respective companies to the maintenance of the labor provisions of the code of fair competition for the steel castings industry and declare that it is for the best interest of the industry that such provisions be so maintained throughout the industry, provided, however, that it shall be permissible to use 26 weeks as a basis for determining the average employment of not to exceed 40 hours per week as prescribed."

"In addition to the base wage and hour provisions contained in the code recognized differentials in wage payments were reaffirmed by various members. With reference to those questions of fair trade practice and other provisions, details of operation by voluntary recognition of such principles were recommended. Numerous expressions contrasting the previous condition of the industry with standards of business practice which had been attained testified to the benefit of co-operative action. The maintenance of higher labor standards and the elimination of destructive competition were definitely credited to the co-operative spirit engendered in the industry by the code. It was the consensus of opinion at the meeting that regardless of the invalidation of NIRA, the steel foundry industry desires to maintain so far as it is permitted such business standards as were established under the code in the interests of the members of the industry, their employes and customers. The office of the society will continue to gather and disseminate statistical information which has been found to be desirable and beneficial. It was not deemed practical to continue open price reporting, but statistical data concerning past closed transactions relating to production, distribution and marketing of steel castings in all phases were held to be desirable.

In the assembling of wage reports covering rates of pay and hours of labor, the service of field representatives has been found to be beneficial. Accordingly, such field men will be retained and also will be available for carrying on cost education work which is a valuable function of a trade association.

Trade practices recognized as damaging, such as: secret rebates, allowances, special concessions or other deviations from recognized practices as well as selling products below cost to the injury of a competitor were condemned and disclaimed by members of the industry.

ADVERTISING PAGES REMOVED

Soaking up a litle culture

The Adventures of Bill

BY PAT DWYER

THE old book worm himself, hey?" Bill plumped himself down in a veranda chair and craned his long neck to note the title of the book which I had been reading in peace and comfort until he invaded the scene. "Poetry? Worse and more of it. How any person presumably in possession of ordinary common sense can waste his time absorbing that kind of drivel is beyond me."

"The fact that a certain subject is beyond the grasp of your limited intelligence," I kindly pointed out, "does not necessarily imply that it is drivel. If you were open to conviction, which I am afraid you are not, I could direct your attention to the fact that the material in this book, written by one Francois Villon has survived through nearly 500 years. It is just as vibrant, just as apropos, just as ringing with truth as it was the day the delightfully humorous, philosophical vagabond set it down with a quill pen in a shivery candle lighted attic in his beloved Paris.

"I'll read you one selection, 'Ballade of Vanished Ladies,' which is about as near as we can come in English to the original title 'Ballade des Dames du Temps Jadis'—"

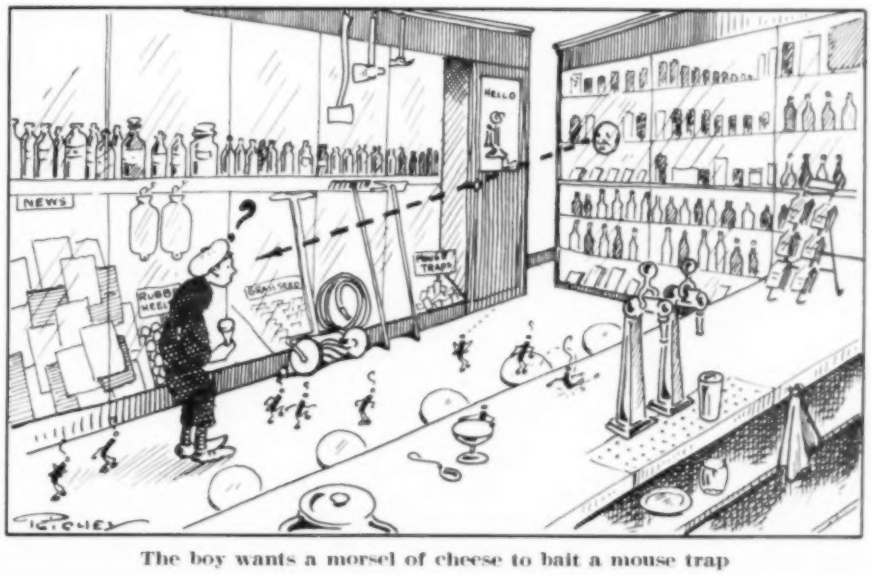
"I get you. Jadis, I take it, is the French twist for jades. This sounds promising. Proceed."

"No. Jadis is not jades. M'sieu Villon, as set down elsewhere, knew about all there is to know about jades, but in this instance he soars in more lofty circles. As in the title his remarks suffer slightly in the English translation. Listen to this: 'Now, say in what land is she, fair Flora of Rome? Again where may Hypparchia be, with Thais in grace germane? Where's Echo, than mortal slain fairer, a voice that goes o'er river and meer of rain? But where are the last year's snows? And where is that learned Heloise, whom Abelard loved in vain, losing at St. Denys manhood in grievous pain? And the queen who did ordain for Buridan his repose, cast in a sack in the Seine, but where are the last year's snows? The white queen fair to see, whose song was a siren's strain! Beatrix, Berthe, Alys, Herembourges who held le Mayne? Joan, the good maid of Lorraine, burned by the English foes. Virgin! Where are they ta'en? And where are the last year's snows?' Now what do you think of that?"

"Not so hot," Bill waved a hand in dismissal. "Where are last year's snows? Who cares? I am more interested in where are last year's mechanics, and the men of the year before and of the year before that. I had a letter the other day from an old friend of mine out on the coast touching on this very subject. This lad, Peter Forbes, served his time—as they say over there—*to* the patternmaking trade in Scotland. Then he came over here and worked at his trade for many years in the Pacific coast area. After nearly 40 years of it he quit about 4 years ago and entered another line of business which permits him to ramble about a bit from the Mexican border line to British Columbia.

"During the past 4 years he has met many former molders and patternmakers who either have carved new niches for themselves in the economic structure, or have applied their skill and training in lines allied to those in which they formerly were employed. These examples probably may be duplicated in all sections of the country. He said that he was prompted to present these examples for the benefit of others who may profit by suggestion or inspiration.

"With returning prosperity many manufacturers in surprise are asking themselves—like your friend Villain or Villong, or whatever it is—you know, the snow fella—where are the skilled mechanics of yesteryear? Paradoxical as it may seem with millions of men still idle, employers are finding difficulty in recruiting their staffs. The situation is complex and involves many reasons. One is that under reduced operating conditions the former steady stream of boys has not been entering the skilled trades. Another is that machinery has displaced large numbers of skilled mechanics, and has introduced the necessity for a new type of skill outside the scope of that formerly practiced. A third is that many men forced into idleness have found other means of making a living, and either find it more to their liking, or, hesitate to go back to the shops until they feel assured of higher remuneration or steady employment or both. Also during the depression period the old man with the scythe



The boy wants a morsel of cheese to bait a mouse trap

has been busy in the ranks either mowing them down or relegating them to the side lines.

"Peter writes a chatty letter. He has found foundries in unexpected places. An up to date foundry is operated in connection with a large paper mill on Powell River, 100 miles north of Vancouver, B. C. This mill, one of the largest, if not actually the largest in the world has a capacity of 1000 tons of newsprint per day. A similar foundry forms part of the plant of another paper mill at Ocean Falls, nearly 300 miles north of Vancouver. "The geographical minded person, Peter points out, may be interested to know that Ocean Falls is above the 50th parallel of north latitude and probably is the farthest north foundry on the American continent with the exception of a shop at Juneau, Alaska, 134 degrees west and 58 north. Almost at the other end of the scale are four small foundries in San Jose (Hose-ay, *if* you please) a beautiful city about 50 miles south of San Francisco, entered through long, wide avenues lined with tropical trees and blooming flowers. Principal product of these foundries is a special type of pump for irrigating the fertile valleys surrounding the city.

"Omitting from the list a great number of former mechanics engaged as salesmen of one kind and another, Peter confines himself to men engaged in other activities. A former molder, always interested in dogs, now is prospering as owner and operator of a dog hospital. In addition to his wife, he has three employes helping him take care of pampered pets temporarily under the weather. Another molder does a good business raising live pets for children.

"A molder formerly from South Framingham, Mass., is operating his own nursing home. Sixty one, he has been all over the world as a sailor and soldier and his experiences would fill a book. He always had been interested in first aid work, and the depression just naturally shook him into his proper sphere in life.

"Considering the high degree of skill and manual dexterity developed by wood patternmakers, it is rather strange to find that so few drift into other wood working lines. True, all wood patternmakers are not first class wood workers, but it is fairly safe to say that the majority are highly efficient. One of these men—whether by actual demonstration or through observation, deponeth sayeth not—became dissatisfied with an ironing board. He developed and patented an improved type particularly designed for use in apartment buildings. A former molder—a big Swede—now is doing well in his own second hand furniture store.

"Another patternmaker as a hobby started building model boats, later branching into the construction of full size vessels. Finally he built a boat 40 feet in length in which he and his wife toured the entire Pacific coast and then sold the boat at a handsome profit. At present this man operates a boat building plant employing ten men.

"Furniture repairing presents a wide field. Properly speaking this is a cabinet maker's job, but in many respects the work is ideal for a man with a patternmaker's training. A pattern-

One job the molder can't spoil

maker in Vancouver has been kept busy repairing violins and in between times he has constructed three complete instruments. Another man in the same city has developed quite a business in the manufacture of individual hand made pipes for those who can afford to trifle with my lady nicotine in an exclusive manner. An Oregon patternmaker with an artistic sense is doing quite well, thank you, in building rustic furniture for summer cottages, porches and gardens.

"Two men in Washington make spruce trunks for automobiles. They also design and build a special line of salesmen's sample cases. One particularly attractive example is a sample case for a perfume salesman. The trays are carved for bottles and the spaces are lined with velvet.

"In San Francisco a man is kept busy on special boxes about 8 x 8 x 18 inches, of ⅜-inch birch, with trays, etc., to be used in pool rooms and other places for games of chance. Peter regrets that he is not familiar with the operation and technique of these devices. Neither is the man who makes them. He simply builds them to the customer's order. He gets $3.50 for each one and he can knock out three in a 6 or 7-hour day. The materials cost him $2.00 for the three and he pays a jobbing shop pattermaker 50 cents per day for the use of his shop. At the time Peter saw him he had orders for several hundred.

"Seems to me," Bill remarked at this time, "there is a moral or a parable or something in that. Whether a patternmaker is building gambling devices for a pool room or patterns for a foundry, he is always mixed up in some way with a game of chance.

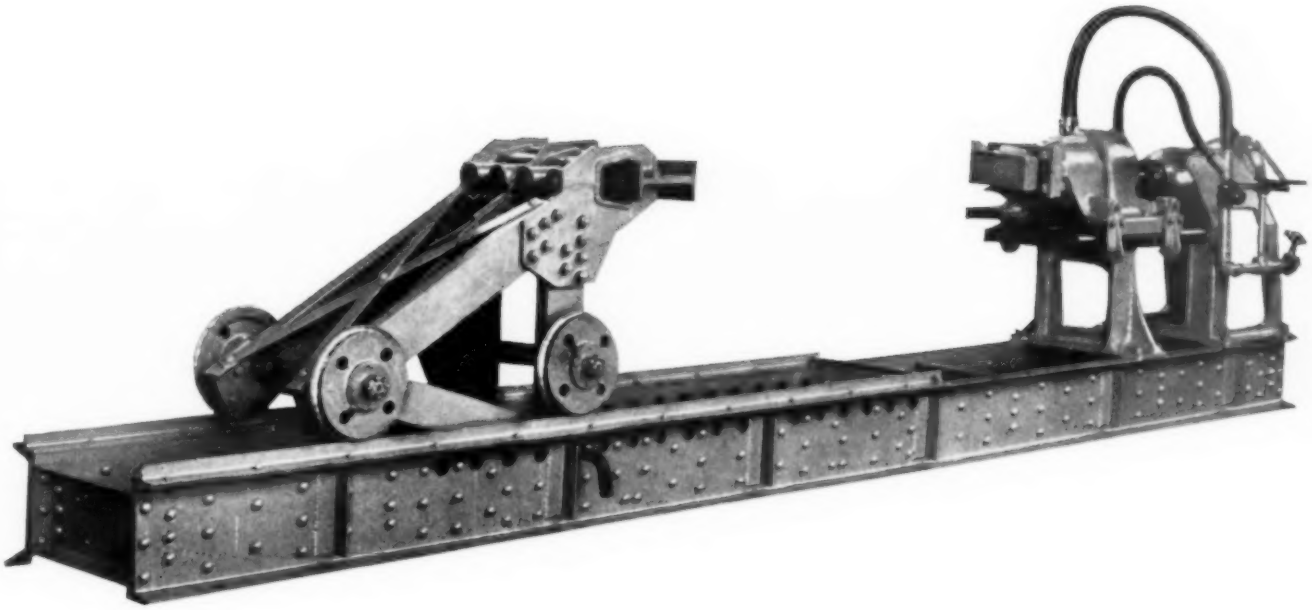
"Plywood which now can be secured almost any place, easily is made into many articles for household use. Two patternmakers in Los Angeles working overtime, use nothing but plywood.

"A southern California patternmaker makes a special line of highly artistic fire screens, designed to conceal the fire place when not in use.

"I suppose," Bill interrupted himself for a moment, "I suppose I should not have mentioned that item. According to a popular impression among those who never have visited that delectable land, fire places are not needed. Apparently as with the appendix and —er—one or two other useless appendages of the human form divine, the fireplaces are stuck in through force of habit, by builders who learned their trade elsewhere. However, there they are and since they must be concealed, what is better than an elegant hand made wood screen? In some instances the screens are finished in the natural wood, but if the customer desires the panels painted, the artistic maker can do that little job for him. No accounting for tastes. I knew a woman one time who bought a house from a man who had built it for himself and who had it paneled and beamed in oak. The minute she got in—almost—she covered every inch of that beautiful wood with a coating of white paint!

"Several patternmakers have found an outlet for their spare time in designing and constructing picture frames and other gadgets for drug stores. The modern drug store handling everything from mouse traps to rubber heels and dog harness, has practically the entire stock on display. Quite a contrast to the old fashioned, dimly lit cave, in which the stock was kept securely hidden in rows of drawers behind the counter. Where the proprietor lurked behind a partition at the back of the store and peeped slyly through a knot hole, before emerging like a snail from its shell. Back in that holy of holies he popularly was supposed to be engaged in compounding fearful and wonderful remedies for man and beast. Looking back now and adding two and two together, I am rather inclined to the opinion that he spent most of his time reading ponderous editorials in the weekly newspaper, with a dip now and again, by way of variety into a few of the more sprightly patent medicine almanacks. In fact it is just possible that he tried to brush up on his elementary French, by painfully spelling out some of your friend Villong's stuff in the original. Where are last year's snows? If you ask my opinion that was just about the least of his worries—as it is of mine!"

Stoney Knockout Machines



A HEAVY DUTY TYPE

designed especially for steel foundry and heavy gray iron work.

Used for cores and molds.

We specialize in equipment for shaking out molds and removing cores from castings.

We build in any size or style to suit your requirements.

Submit your problems to us

The Stoney

Foundry Engineering & Equipment Co.

5321 St. Clair Avenue Cleveland, Ohio

Manufactures Plumbers' Supplies

(*Continued from page* 25)

crucible and secured with a link. Each jaw of the tongs is provided with a trunnion by which tongs and crucible are suspended from a bail. The bail in turn is engaged by a hook suspended from the monorail. These various features are illustrated in Fig. 3. Up and down movement of the crucible is regulated by a chain hoist, while leverage for tilting the pot is secured through the handle of the tongs.

This is a departure from the long established conventional method where the crucible is carried in a long shank and where four men are required, one on the hoist, one at each end of the shank, and a fourth holding the skimmer. In the present method two men handle the crucible. One operates the chain hoist, while the second man stands directly in front of the crucible. With one hand he grasps the top of the tongs and tilts the crucible. He manipulates the skimmer with the other hand. To protect his feet from metal splashes he wears a brass replica of a half shoe over the leather shoe on each foot.

Castings Are Plated

Majority of the castings are made from a mixture known familiarly as red metal or eighty-five, three fives; that is copper 85 per cent, tin 5 per cent, zinc 5 per cent and lead 5 per cent. Melted under proper conditions and poured into well made molds this metal makes clean, dense, pressure proof castings, readily machinable and easily plated. The tendency in recent years has been toward chromium rather than to the nickel finish formerly popular.

Furnace charges are made up of ingot metal supplemented by return scrap from the cleaning room and machine shop. Close supervision is exercised over the collection of this scrap in suitable containers and the making up of the charges to conform to definite specifications. Majority of the men have been employed by the company for many years and as a result are highly skilled in the performance of their various duties.

Thus each molder shakes out his own castings and cuts over his own sand, a grade known as No. 0 Albany. Through judgment based on long experience the molder tempers the sand to meet the particular requirements of the job on which he is engaged. He may not be able to express in figures the permeability, bond or moisture content, but he can take a handful of the prepared sand, squeeze it, break it apart, look at it and decide to the traditional cat's hair whether it is or is not suitable for his requirements. The foundry superintendent, a practical molder, has been in charge of operations for many years. This accumulated wisdom is available for the original set up of the patterns and gates on all new work, and for the ironing out of any minor or major difficulties that arise from time to time.

The foundry is well lighted through an almost continuous window in the side and end walls and through additional windows in the sides of the high roof. Swinging sections in the windows provide ventilation. This feature is supplemented by an extensive piping system which delivers hot air in winter and cold ar in summer. Except in subzero weather it is claimed that the temperature of the building easily is maintained at approximately 70 degrees Fahr. The furnaces are located near one end of the building and in that manner any smoke or fumes incident to the melting operation do not permeate the remainder of the building. Although metal is poured continuously throughout the day, the operation is spread over a large area and over a long period and as a result the volume of smoke and steam does not constitute a detrimental or annoying factor at any time.

Cleaning the Castings

Castings are taken from the foundry to an adjoining room equipped with the necessary equipment for preparing them for the various operations. In the first step the castings are nipped from the gates in four belt-driven sprue cutters, automatic machines in which the gate is severed between a stationary bottom knife and an upper knife actuated after the manner of the tool in a punch press. The castings fall into a wheelbarrow and are taken to one of two enclosed barrel sandblast units, one made by the American Foundry Equipment Co., Mishawaka, Ind., and the other by the New Haven Sandblast Co., New Haven, Conn. Gates and sprues are wheeled back to the vicinity of the melting furnaces.

In the next stage the cleaned castings are taken to a battery of five double stand grinders where gate stumps and fins, if any, are removed. From this point some of the castings are taken directly to the machines or placed in stock, while the castings to be plated are given an additional finish in a revolving barrel through which water is kept flowing. Wages of the cleaning room crew are based on the weight of castings handled and are prorated on an hourly basis according to an arbitrary appraisal

(*Concluded on page* 68)

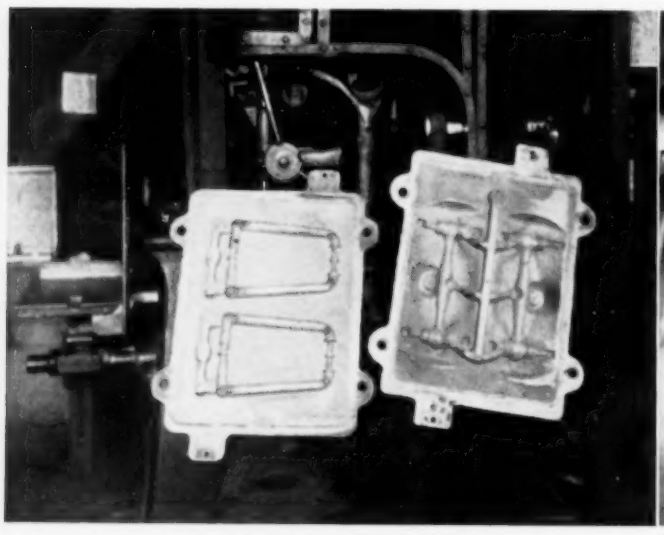
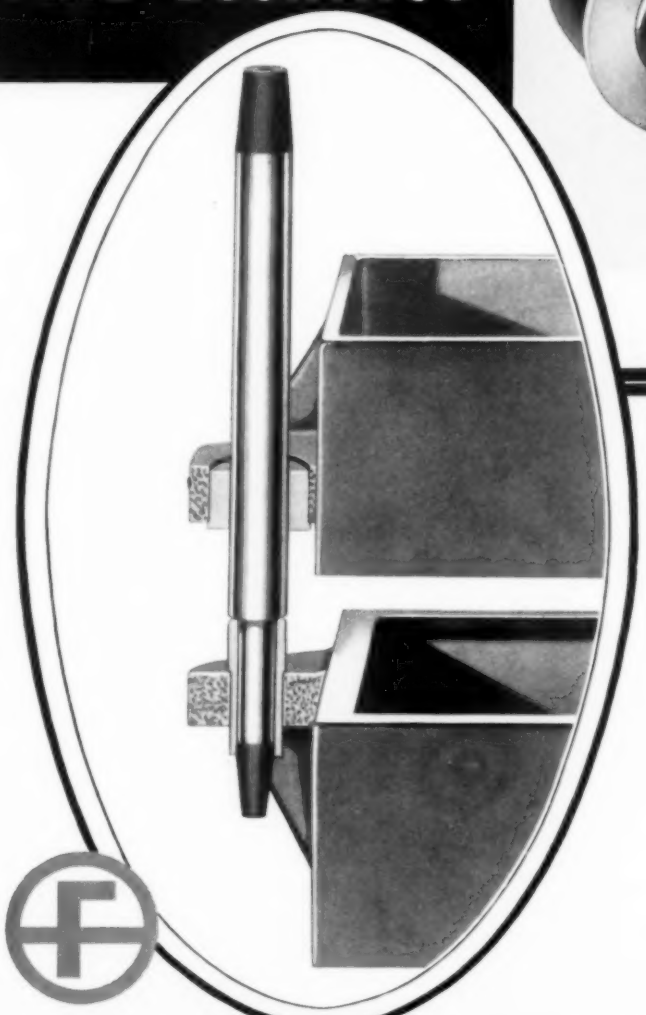


Fig. 6 (Left)—Typical pattern plates showing gating arran gement. Fig. 7 (Right)—Cast iron door frames, doors and shelf plates show no deterioration or warpage after 30 years' service

Interchangeable FLASK PINS AND BUSHINGS



Four *Reasons* why you can *Positively Cut* Production Costs with

Interchangeable Flask Pins —and Bushings

1—They eliminate ear wear and breakage

2—They prevent wedging

3—The drag cannot shift

4—Easily and inexpensively installed with standard reamers

Write for new descriptive bulletin.

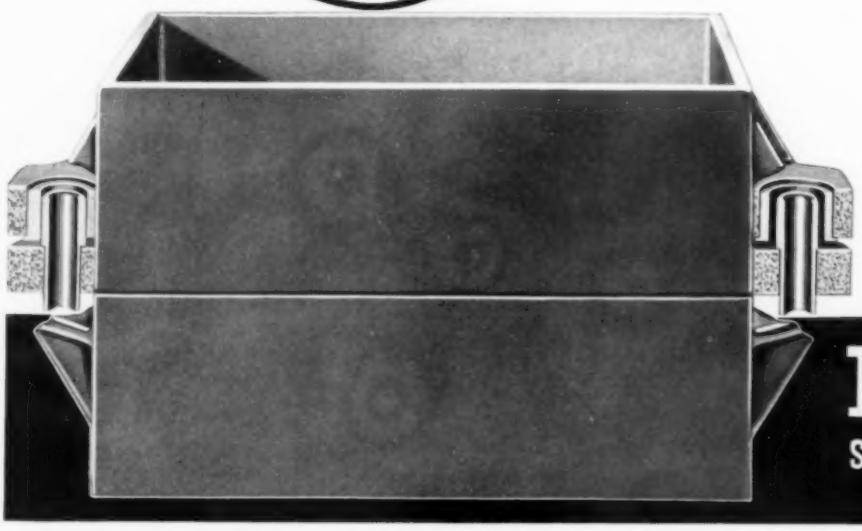
•

Manufactured and stocked only by

FEDERAL SCREW WORKS

Sole Licensee

DETROIT, MICHIGAN



FEDERAL

SCREW WORKS·DETROIT

(*Concluded from page* 66)

of each man's speed and skill. The system engenders close co-operative effort and requires little or no supervision.

On account of the limited metal thickness of the castings and the intricate shape of many of the cores, dryer shells are necessary to support the cores in the green state and while they are in the ovens. In some instances it is possible to ram sand in the coreboxes while the halves are assembled. In other cases, the two halves of the corebox are filled with sand independently. Then the halves are brought together—booking is the foundry term—to form a complete core. The upper part of the corebox is removed and replaced by a light metal shell which conforms in a general way to the shape of the core and comes into intimate contact with it at the points which require support. The assembly is inverted and the second half of the corebox is removed, leaving the completed core in the shell.

New sharp sand bonded with oil is prepared for core room use in a paddle type mixer made by the Blystone Mfg. Co., Cambridge Springs, Pa. In certain instances where the cores are dried without the aid of dryer shells, a limited amount of old molding sand is added to the mixture to furnish the necessary green bond strength. The molding sand reduces the permeability and cannot be used, for example, in light, fragile cores where the vent has to escape through a constricted area and practically instantaneously.

In many instances it is necessary to make and dry a core in two parts. Later the two parts are joined with a little paste at the junction point, usually a male and female arrangement. The assembling is done in a jig or dryer shell which then supports the two parts in correct position while the paste is drying in the oven. A typical lot of cores, dryer shells and plates is shown in Fig. 5.

Cores are dried in a battery of eight coke fired ovens shown in Fig. 7. For simplicity of construction, efficiency and years of service these ovens are rather remarkable. They have been in constant use for over 30 years, and so far as appearance is concerned they are in as good condition as when they were erected, another testimonial to the enduring quality of cast iron. The front frame, jambs, threshold, lintel, doors, hinges, is made up of cast iron parts. Each of the four shelves is 4 x 5 feet, made up of 8 perforated thin cast iron plates, each 12 x 30 inches. The outer ends of the plates rest on cast iron supports at the front and the back of the oven. The inner, adjoining ends rest on a cast iron bar extending across the center of the oven and anchored in the side walls.

The oven extends full size to a depth of 5 feet below the floor level. At the lower level and in the center of the floor a rectangular cast iron fire basket 12 x 24 inches contains a coke fire. The chamber is practically air tight. Combustion of the coke is accelerated or retarded by a sliding door in the back wall. When opened full size the door is large enough for the attendant to add coke to the fire or remove the ashes. The fire is far enough below the lowest shelf in the oven to prevent any direct flame from coming in contact with the shelf. The comparatively large chamber permits the heat to expand and thus be diffused throughout the entire oven at a fairly uniform and suitable temperature. It is claimed that many of the lighter cores can be dried in from 10 to 15 minutes.

Diversity of items entering into the product of the company is illustrated in the pattern storage vaults where over 5000 plates are arranged methodically in numbered aisles and racks. Changes in fashions and improvements in design in castings intended for household, municipal and manufacturing purposes are reflected in this department. Certain parts practically are obsolete, but are held in stock to meet occasional orders for replacement.

Patterns are numbered according to an exceedingly simple and efficient system. Several years ago the then existing patterns irrespective of size, shape or style were numbered serially from No. 1 upward. Since that time, each pattern as it is completed is given a serial number, one in advance of the preceding pattern. Wood master patterns are made on the outside, but the metal patterns and plates are made in a well equipped metal pattern shop maintained by the company. In some instances the plate and pattern is cast as a unit as shown in Fig. 6, while in other instances the individual patterns first are finished and then attached mechanically to the plate.

German Founders Hold Meeting in Berlin

The twenty-fourth annual meeting of the Verein deutscher Giessereifachleute or Association of German Foundrymen was held in Berlin on June 1 and 2. On the afternoon of the first day four papers were presented K. Roesch, A. H. Ludwig, E. Knipp and W. Baukloh. Mr. Roesch discussed wear resistance research on alloyed and unalloyed steel castings while A. H. Ludwig described the various methods of casting nonferrous metals centrifugally. Gas cavities or pinholes in castings with special reference to steel castings was the topic of the paper by E. Knipp and W. Baukloh concluded the meeting with a discussion on the effect of hydrogen on cast iron.

On the morning of June 2 the meeting was opened by the president of the association, W. Bannenberg, who spoke on the benefits conferred on all in the foundry industry through activities of the association and its members. Following his address on resolution of the directors of the Association of German Foundrymen, Prof. Bernhard Osann was presented the Adolf Ledebur medal in recognition of his prominent services in furtherance and development of, and research in, foundry practices.

After presentation of the medal the technical session was opened with a paper by Franz Bischof on "Influence of Elevated Temperatures on the Mechanical Properties of Gray Cast Iron with Various Phosphorus Contents." That was followed by a discussion on "The Influence of Alloying Elements on the Structure and Physical Properties of Cast Iron, especially the Effect of Nickel, Molybdenum and Chromium," by H. Uhlitzsch. The meeting was closed with a talk by Karl Kasper on "Technique, Economy and International Aspects."

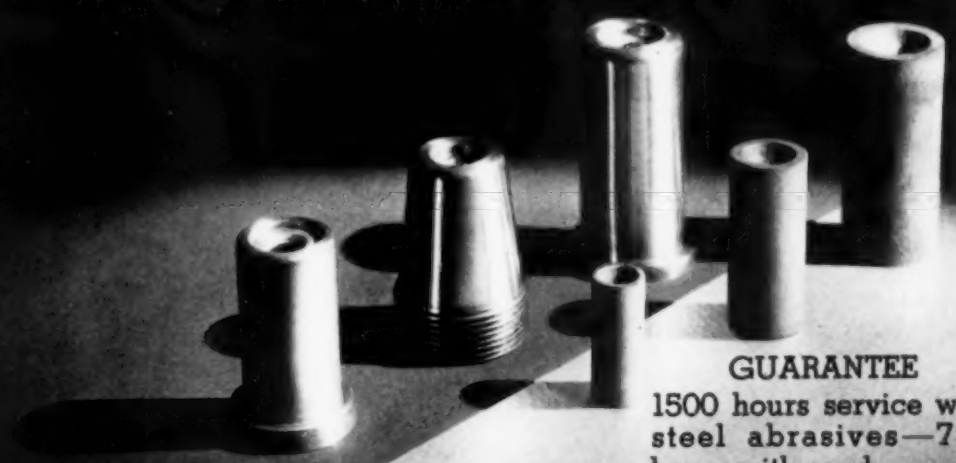
Revamp Association Of Nonferrous Foundries

Reorganization as an active trade association formed the basis for a meeting of the board of the Nonferrous Foundry association held in Detroit, June 28. The code authority for the industry was dissolved on announcement of the supreme court decision relating to NRA. However, the association, which has acted as administrative agency under the code for the nonferrous foundry industry, actuated by a desire to retain the benefits of co-operative action, took steps to further such purposes.

With N. K. B. Patch, Lumen Bearing Co., Buffalo, president of the association presiding, the board took action to appoint committees on budget and finance, rules and regulations for local chapters, plans and purposes and to make preparations for the annual meeting which will be held in the fall.

Continuation of local chapter activities which have proved distinctly beneficial to the industry will be carried out with but slight change. Revision of reports, perfecting of the recognized cost system of the association and continued activity on behalf of jobbing foundry interests are embraced within the plans of the association. Sam Tour, Lucius Pitkin Inc., New York is executive secretary of the association.

PANGBORN-NORBIDE*
"LONG-WEAR" BLAST CLEANING NOZZLES



GUARANTEE
1500 hours service with steel abrasives—750 hours with sand.

*Trade-mark of Norton Co. for Boron Carbide

PANGBORN CORPORATION
The World's Largest Manufacturer of Blast Cleaning and Dust Collecting Equipment
HAGERSTOWN - - - - MARYLAND

CRANES and TRANSFER BRIDGES

as self contained units or as part or parts of a more extensive—

OVERHEAD MATERIALS TRANSPORTATION SYSTEM

give complete coverage or unit coverage for just the portion of your plant requiring this service under either full or short time production schedule.

Starting Effort 15 pounds . . . } per Ton of
Running Effort 10 pounds . . } Total Weight

Smooth running for the most delicate or dangerous load.

• Hand propelled transfer bridges give complete coverage on foundry floors and when push button controlled pouring devices are used in connection with them they make an ideal pouring unit.

Consult your 'phone directory under "Cleveland Tramrail"

CLEVELAND TRAMRAIL

THE CLEVELAND CRANE & ENGINEERING CO.
WICKLIFFE OHIO

A. S. T. M. Studies Standards

(*Continued from page 27*)

on steel had completed its work. In closing he expressed appreciation of his committee for the work and service of Prof. H. F. Moore, University of Illinois, Urbana, Ill., whose term just expires.

Report of committee E-1 on methods of testing was presented by W. H. Fulweiler, United Gas Improvement Co., Philadelphia, chairman, and the report included proposed, revised specifications for round-hole screens for testing purposes. Following that report R. N. Traxler and L. H. Baum, Barber Asphalt Co., Maurer, N. J., presented a paper on the measurement of particle size distribution by optical methods.

H. C. Mann, Watertown Arsenal, Watertown, Mass., discussed the relationship between the tension, static and dynamic tests and he pointed out that the dynamic impact test gives a total energy value, while this is not obtainable in the static test without additional investigation to determine its internal energy value. He then described a method for the procedure.

Hardness Testing Light Alloys

R. L. Templin, Aluminum Co. of America, New Kensington, Pa., discussed hardness testing of light metals and alloys, pointing out that effects of various factors such as load-penetrator-time relationship, size and preparation of specimens are quite different than for ferrous metals, and that relationships between different kinds of hardness and between hardness and other static properties of light alloys also are not the same as for ferrous metals. C. E. Topping, Dow Chemical Co., Midland, Mich.; F. E. Fuller, Wright Field, Dayton, O.; Dr. L. B. Tuckerman, National Bureau of Standards, Washington, and R. L. Kenyon, American Rolling Mills Co., Middletown, O., discussed his results. After the discussion W. M. Patterson, Tinius Olsen Testing Machine Co., Philadelphia, described a new method and machine for dynamic hardness testing.

After a brief recess H. F. Moore, University of Illinois, Urbana, Ill., assumed chairmanship of the meeting which then took the form of an informal discussion of the significance of yield strength of metals in design and specifications. H. H. Morgan, R. W. Hunt Co., Chicago, spoke on the subject from the viewpoint of the testing engineer, stating that exact knowledge was necessary for research problems while for design the regular commercial test was suitable. L. H. Fry, Edgewater Steel Co., Pittsburgh, discussed yield strength from the viewpoint of ferrous metals, and pleaded for a classification of materials into groups having similar properties so that definitions of yield strength, proportional limit, yield point and elastic limit for each type could be more clearly defined. Yield strength from the viewpoint of nonferrous metals was discussed by R. L. Templin who pointed out that yielding phenomenon, occurring in mild steel, does not appear in nonferrous metals so a rather arbitrary value has been adopted. However, long testing experience has demonstrated that it is accurate within acceptable limits, practical and useful. The final discussion on the program was by M. F. Sayre, Union college, Schenectady, N. Y., who spoke on elastic strength and its relationship to creep.

Corrosion of metals, a hazard recognized in life and service of nonferrous, as well as ferrous metals formed the main theme of a session of the American Society for Testing Materials, held Thursday morning. Numerous committees of the society make this subject the object of intensive investigation, plan accelerated means of forecasting ultimate results and have developed means of measuring and evaluating results.

Reporting for the committee on iron-chromium, iron-chromium-nickel and related alloys, Jerome Strauss, Vanadium Corp. of America, Bridgeville, Pa., recommended tentative specifications for sheets, strip and plates of chromium-nickel steels and for three classes of chromium steel castings, containing 12, 19 and 28 per cent respectively of the controlling alloy. All of these latter specifications provide that the steel shall be made in the electric furnace.

Three new specifications covering electrodeposited coatings of zinc, cadmium, and nickel and chromium on steel were proposed in a report presented by F. F. Farnsworth, Bell Telephone laboratories, New York. These provide standards for time and current density. A continuous flow corrosion test method for steel pipe was described in a paper by H. S. Rawdon and L. J. Waldron, bureau of standards, Washington.

Air-conditioning equipment, a recent commercial development, has brought problems relating to corrosions in materials used, according to a paper by C. M. Sterne, Metropolitan Refining Co., Long Island City, N. Y. Attack upon metallic parts of this equipment has been found in some cases to destroy pipes and sheets within as short a period as four months. A series of tests on more than 200 air-condition systems, both of the comfort type and the industrial conditioning equipment, show that by proper chemical treatment of the circulating and cooling medium and supervision, the attacks may be reduced. Sodium dichromate is said to give the best protection and also serves to remove organic odors from wash water in air-conditioning.

A paper by H. E. Searle and F. L. LaQue, International Nickel Co., New York, presented by the latter showed the results of field corrosion tests employing a spool type of specimen holder carrying various types of materials. Comparison was made between the method outlined and standard practical conditions were made, notably in the case of cast filter support guides used in dewatering and drying salt. Here ni-resist and unalloyed cast iron specimens and the standard grids showed a similar result, with the former giving only one-twelfth the corrosion effect on the latter.

Spectrographic Analysis

Following the report of committee E-2 on spectographic analysis which was presented by H. V. Churchill, Aluminum Co. of America, New Kensington, Pa., a symposium on spectrographic analysis was held Friday morning. The symposium included six papers relating to application of the spectrograph to ferrous and nonferrous metals and alloys. The first by W. R. Brode, Ohio State university, Columbus, O., described spectrographic analysis of steel samples. H. E. Stauss, Baker & Co. Inc., Newark, N. J., spoke on the use of the spectrograph in the platinum industry while J. S. Owens, Dow Chemical Co., Midland, Mich., gave information on quantitative spectrographic analysis of magnesium alloys for manganese and silicon. Procedure for determining impurities in commercial cadmium by the spectrograph was described by Miss Frances W. Lamb, Bohn Aluminum & Brass Corp., Detroit. M. L. Fuller, New Jersey Zinc Co., Maurer, N. J., talked on the purification of graphite electrodes for spectrochemical use, and the final paper was by R. A. Wolfe, University of Michigan, Ann Arbor, Mich., on quantitative analysis of nonferrous alloys by spectrographic analysis.

Discussions following the various papers brought out the fact that the spectrograph in many instances forms an extremely useful instrument for rapid, accurate, quantitative determination of various elements in ferrous and nonferrous metals and alloys. To a great degree use of the spectrograph is being less and less confined to ministrations of experts so that it may be used by the average intelligent laboratory assistant for

(*Concluded on page 73*)

ADVERTISING PAGES REMOVED

(*Concluded from page 70*)

routine analysis.

High Temperature Effects

Report of the joint research committee on the effect of temperature on the properties of metals presented by Prof. A. E. White, University of Michigan, Ann Arbor, Mich., outlined the progress made since the last meeting. Samples of 0.40 per cent carbon steel were distributed to 10 or more laboratories for high temperature tension tests. An appendix to the report pointed out that cast and wrought 18 per cent chromium, 8 per cent nickel steel shows a moderate loss of impact resistance after heating 100 hours at 1400 degrees Fahr., and only minor changes in impact resistance with further heating up to 3780 hours. A satisfactory impact resistance remained after 3780 hours heating at 1400 degrees Fahr.

John W Bolton, Lunkenheimer Co., Cincinnati, described tests on tin bronzes containing respectively about 88 per cent copper, 10 per cent tin, and 2 per cent zinc; and 88 per cent copper, 6 per cent tin, 4 per cent zinc, and 2 per cent lead. He stated that in his opinion the latter alloy was suitable for use at 500 degrees Fahr., and possibly 550 degrees Fahr. and at 500 degrees Fahr., the design stress should be limited to 5000 pounds per square inch. In the case of the 88-10-2 alloy, the load carrying ability at 500 degrees Fahr. is lower than for the other alloy, and there is a distinct evidence of embrittlement. Discussion of the paper was presented by Prof. White; H. W. Maack, Crane Co., Chicago, who stated that work he conducted agreed with Mr. Bolton's; E. R. Darby, Federal-Mogul Corp., Detroit, who inquired what results might be expected if completely stabilized alloys had been used, and Robert Job, Milton Hersey Co. Ltd., Montreal, Que. T. H. Kilgrehn, International Nickel Co., New York, sent in a written discussion.

Describes Creep Tests

Results obtained from extended time creep tests on plain carbon steel and chromium-silicon-molybdenum steel conducted by A. E. White, C. L. Clark and R. L. Wilson, University of Michigan, Ann Arbor, Mich., were described by Mr. Clark. They indicate that creep rates are influenced by the length of time they are extended. Comments on the paper were given by Prof. H. F. Moore, University of Illinois, Urbana, Ill.; John W. Bolton; Don W. McCutcheon, Ford Motor Co., Detroit; Mr. Rice, Marquette Railway Co., and E. L. Robinson, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

R. R. Kennedy, U. S. Army Air Corps, Wright Field, Dayton, O., discussed creep characteristics of nine aluminum alloys used in aircraft engine construction. Temperatures of 400 and 600 degrees Fahr. were used as they were in the usual operating range. Sand-cast, aluminum-copper-nickel-magnesium alloy had the best creep characteristics, but other new cast and wrought alloys are being found serviceable because they have better casting and forging properties. Report of the research committee on fatigue of metals was presented by Prof. H. F. Moore, chairman, and it included notes on fatigue tests on rotating beam testing machines.

A rotating-wire arc fatigue machine for testing small diameter wire was described by J. N. Kenyon, Columbia university, New York, and the session closed with a paper on high speed fatigue tests of several ferrous and nonferrous metals at low temperatures, by W. D. Boone and H. B. Wishart, University of Illinois, Urbana, Ill. Results obtained by the authors showed an increase in endurance limit as the temperature decreased from plus 80 degrees Fahr. to minus 50 degrees Fahr.

Closing session of the American Society for Testing Materials annual meeting was devoted to the metallography of nonferrous metals, and was presided over by H. A. Anderson, Western Electric Co. Inc., Chicago. Dean Harvey, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., presented the report of committee B-4 on electrical heating, electrical resistance and electric furnace alloys while that of committee B-5 on cast and wrought copper and copper alloys was presented by W. B. Price, Scovill Mfg. Co., Waterbury, Conn. Report of committee E-4 on metallography was presented by C. H. Davis, and he called attention to a proposed tentative recommended practice for metallographic testing of ferrous and nonferrous metals which was included. That practice recommendation is an extensive and complete work covering all phases including a bibliography.

J. R. Townsend, Bell Telephone Laboratories Inc., New York, presented the report of committee B-6 on die cast metals and alloys which included a proposed tentative specification for lead and tin base alloy die castings. That specification gives chemical composition of five grades in order of decreasing tin content. In addition the report mentioned a study of aluminum base die casting alloys which has been completed; completion of the testing of zinc and aluminum alloys from the 5-year indoor and outdoor corrosion racks, and the finishing of die castings.

Dow Chemical Co., Midland, Mich., and the Cleveland-Cliffs Iron Co., Cleveland, have joined in organizing the Cliffs-Dow Chemical Co. to manufacture chemicals derived from wood.

Obituary

JAMES DUFF, 51, manager, Staveley Coal & Iron Co.'s sand spun pipe department, near Chesterfield, England, died recently. Mr. Duff had visited in the United States and was well known to a number of American foundrymen. He started his career as an apprentice molder in the foundry trade and in 1911 went to India as a foundry manager of the Bengal Iron Co., Ltd., where he remained for 17 years, gaining a knowledge of the eastern trade. He returned to England in 1928 and was appointed foundry manager with Cochrane & Co., Dudley and in November 1930 he became connected with the Staveley Coal & Iron Co.

* * *

J. Polk Tarwater, 63, president, Rockwood Stove Works, Rockwood, Tenn., died June 17.

* * *

Charles W. Peterson, 72, head of the Standard Pattern Works, Rockford, Ill., for 15 years until his retirement in 1925, died in Rockford, June 4.

* * *

Willard A. Van Brunt, 88, pioneer farm implement manufacturer, Horicon, Wis., died in Los Angeles, June 5. Mr. Van Brunt was president of the Van Brunt Mfg. Co., founded by his father in 1860, from 1901 to 1918. He retired to live in California after selling the business to Deere & Co., in 1918.

* * *

Walter F. Dixon, 70, works manager, Singer Mfg. Co., Elizabethport, N. J., and vice president of the Diehl Mfg. Co., electric division of the Singer Mfg. Co. Plainfield, N. J., died June 18. Born in London, he came to this country as a young man, serving as mechanical engineer at the Rogers Locomotive Works, Paterson, N. J. and later becoming connected with the locomotive department of the Sormobo Works in Russia as manager and chief engineer. From 1900 to 1917 Mr. Dixon managed the Singer plant in Podolsk, Russia, returning to this country in 1918 as special representative in New York. Mr. Dixon was a member of the A.S.M.E. and a former president of the Engineers club of Plainfield.

Buffalo Warehouse

Certified Core Oil & Mfg. Co., Chicago, has opened a Buffalo warehouse and will distribute its various grades of core oil through the Combined Supply & Equipment Co., 766 Grant street, Buffalo.

Officers Elected By Philadelphia Chapter

W. B. Coleman, W. B. Coleman & Co., Philadelphia, was elected chairman of the Philadelphia Metropolitan Chapter of the American Foundrymen's association, at a meeting held June 12 at the Engineers club. Karl Dodge, Olney Foundry Co., was elected vice president and Earl S. Sparks, secretary-treasurer. Directors were elected as follows: Three years, Charles W. Schley, Philadelphia Bronze & Brass Corp., and A. W. Bowman, Schneider-Bowman Co., Inc.; two years, C. H. Newcomb, Rogers-Brown Lavino Co., and R. M. Carrigan, H. W. Butterworth & Sons Co.; one year, F. H. Lobb, William Sellers & Co., Inc., and G. L. Coppage, Pusey & Jones Corp.

Following the election, B. H. Johnson, R. D. Wood & Co., and vice president of the A.F.A. escorted Mr. Coleman to the chair. The new chairman spoke chiefly on his appreciation of the honor conferred upon him. He then introduced M. M. Price, Babcock & Wilcox Co., Philadelphia, who talked on the Boulder Dam project, illustrating his discussion with lantern slides and moving pictures.

Pittsburgh Group Stages Annual Outing

A record attendance marked the annual 1935 outing of the Pittsburgh Foundrymen's association, which was held at the Alcoma Golf club, Saltsburg road, Pittsburgh, on Monday, June 17. Despite adverse weather conditions, there were 217 members of the association and their friends in attendance, and over 80 of that number played golf.

Prizes for the tournament were donated by Mackintosh-Hemphill Co., Pittsburgh; Ohio Ferro-Alloys Corp., Canton, O.; J. S. McCormick Co., Pittsburgh; S. Obermeyer Co., Pittsburgh; Industrial Silica Corp., Youngstown, O.; Carborundum Co., Niagara Falls, and the Alcoma Golf club.

The low gross of the day was won by J. H. McCrady of J. H. McCrady Sand Co., Pittsburgh, with a score of 79, which was rewarded with a pen and pencil set. Second low gross was won by C. H. Wiltsie with a score of 86, which was rewarded with a box of cigars. The least number of putts, also meriting a box of cigars, was won by A. J. Jones, Continental Roll & Steel Foundry Co., Pittsburgh, and a prize of three golf balls was awarded to Paul Frey on being nearest to the pin on the second hole.

A kicker's handicap between 70 and 80 was won by W. E. Troutman of Duquesne Steel Foundry Co., whose gross of 95 less a 25 handicap left a net of 70 strokes. J. S. Coxey of Industrial Silica Corp., M. M. Smith of Penn General Supply Co., and George Martin all tied for second prize with a net of 75.

There were four who tied for third at a net of 80. These being O. Nadolny of Duquesne Pattern & Bronze Co., Pittsburgh; W. C. Buske, McConway & Torley Corp., Pittsburgh; H. B. Reed, and C. E. Breitinger.

Equipment Manufacturers To Meet in Toronto

The Foundry Equipment Manufacturers' association is planning a dinner meeting of all equipment manufacturers, to be held at the Royal York hotel on Tuesday, Aug. 20. The meeting falls during the time that the American Foundrymen's association is meeting in Toronto. Following the dinner various subjects of special interest to foundry equipment manufacturers will be discussed. All equipment manufacturers are invited, regardless of association membership.

At the recent meeting of the code authority for the industry and the board of directors of the association many plans were made for future activity, all of which will be discussed at the Toronto meeting.

Make Personnel Changes

Sale of abrasive products of the Norton Co., Worcester, Mass., has been combined into one division, with two parts, one known as sales planning and development and the other as sales operations. Wallace T. Montague has been made manager of sales planning and development, and W. R. Moore, has been made sales manager of the division. E. C. Hughes is assistant sales manager, handling wheel, grain and pulpstone sales and Robert Kirkpatrick is assistant sales manager handling sales of refractories, nonslip floors, and boron carbide. R. M. Johnson will continue as sales engineer, but also will direct the sales engineering work for all abrasive products. All of these activities come under the supervision of W. L. C. Neilson, vice president in charge of sales, and H. K. Clark, general sales manager.

Several other changes in personnel have been made as follows: C. W. Jinnette, for many years district manager for the state of Michigan, has been made regional manager, sales planning and development. P. H. Clapp has been transferred from the Pacific coast to Detroit, as district manager for Michigan. P. W. Wiswell, recently division manager for Behr-Manning Corp., Chicago, has been transferred to the Pacific coast where he will supervise sales activities for both the Norton Co. and the Behr-Manning Corp.

Iowa Foundrymen Study Sand Problems

Regular meeting of the Northern Iowa Foundrymen's association, held in Waterloo, Iowa, May 28, was devoted to a discussion of brass and iron molding sands. One hundred and thirty-five were present including visitors from Charles City, Marshalltown and Cedar Rapids.

W. G. Jones, R. Lavin & Co., Chicago, related some of his experiences with molding sand in various types of brass foundries. He also gave a number of practical tips for solving sand problems.

Lester B. Knight Jr., National Engineering Co., spoke on the characteristics of molding sand. He discussed in some detail the following five controlling factors, which are interrelated: Permeability, strength, moisture, grain size and fines. Mr. Knight stated that the control of fines in sand is one of the newer developments but is becoming increasingly important in the production of good castings.

Discussion was let by F. C. Nus, John Deere Tractor Co., Waterloo.

Northern Illinois Group Considers Cores

Carl E. Schubert, assistant superintendent, foundry laboratory, University of Illinois, addressed the meeting of the Northern Illinois Foundrymen's association held May 14 at the Hotel Hilton, Beloit, Wis. Mr. Schubert spoke on core room practice, discussing various bonding materials available. He pointed to certain advantages and disadvantages found in these materials, and then spoke of permeability, crushability, moisture absorption and the ease with which cores can be removed. Difficulties attending the use of burned core materials were considered.

Booklet Discusses Courses in Engineering

An interesting booklet, recently published by the University of Michigan, Ann Arbor, Mich., presents detailed information on the courses in chemical and metallurgical engineering offered by that institution. The text includes general information on the University of Michigan, the place of the chemical and metallurgical engineer in industry, the facilities for instruction and research offered, admission requirements, fees and expenses, graduation requirements, and other data. The departmental staff of the chemical and metallurgical engineering school is presented, and a list of the publications of the staff is included.

MODERN
Covered and Insulated Ladles—

will guarantee you

Uniform Hot Metal

They will enable you to handle larger amounts of metal; to save the "drop" in the ladles which previously was "pigged"; to protect your men from the heat and gases of the ladle, thus making for better labor conditions.

In the foundry here shown, the alloy iron in the one ton covered ladle lost only 40° of heat after having been transported 400 ft. and poured into hand ladles for 7½ minutes. Rigid inspection of sand, cores, and molding methods means little without the metal temperature control afforded by these improvements.

Open, obsolete ladles are costing you money daily. Send for our ladle catalogue L-34 and details on ladle covers and insulation.

Good to the last drop!
Saving 150 to 200 pounds of metal "drops" that formerly were "pigged"—Covered one ton ladle distributing alloy iron at Motor Castings Co., Milwaukee, Wis.

MODERN EQUIPMENT CO.

Port Washington, Wis. Dept. 112

Foundrymen's Handbook

Second Edition

THIS second edition contains the most complete collection of formulas, tables, weights, specifications and information relating to foundry practice ever gathered together.

Invaluable to the foundryman, the pattern maker, the metallurgist and the executive. Gives, in most convenient form, the exact information you need to solve successfully any problems that may arise in your foundry operations.

Convenient arrangement of subject matter and thorough cross-indexing make it easy to locate information desired.

574 Pages, 6 x 9 inches
Price, Postpaid $6.15 in U.S. and Canada.

The Penton Publishing Co.

Book Department

Penton Bldg. **Cleveland, O**

335-1

BETTER CASTINGS

In the interest of better castings and to assist the modern foundryman in solving his problems, each month in this space we will present a message of interest and value taken from an actual foundry experience.

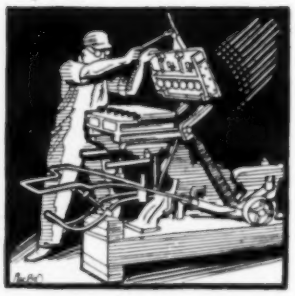
In helping you we believe we will widen our circle of friends and broaden our service to the foundry industry.

Ernest G. Lewis
President

Niagara Falls Smelting & Refining Corp.

Buffalo, N. Y. **U. S. A.**

New Equipment



For Foundries

Machine Cuts Off Risers from Castings

West Co. Inc., 1117 Shackamaxon street, Philadelphia, recently has developed an abrasive cut-off machine for removing gates and risers from nonferrous castings and also adaptable for iron and steel castings. The machine, which is shown in the accompanying illustration, employs a rubber bond abrasive wheel 14 x 1/8-inch operating at 3800 revolu-

Abrasive cut-off machine removes gates and risers from castings

power motor. Difficult shapes are handled by adjusting the wheel head to various vertical and horizontal angles. The work usually is fed into the wheel, and it is said that no special clamping devices are necessary. Also positive safety is guaranteed against wheel breakage.

The machine weighs about 750 pounds and occupies a floor space of 51 x 56 inches over all. The cast iron table is 24 x 36 inches and raises or lowers within a 10-inch range. The wheel head slides forward on specially fitted guides a total of 17 inches if desired. The motor remains stationary. For casting work the wheel head is moved partly forward, locked into position, and the work fed into the wheel. The guard is arranged to allow for cutting odd shapes easily. All working parts of the machine are equipped with ball bearings. It is claimed that even under heavy cutting conditions vibration is absent, and that the machine is very flexible in application. Special vise and clamping mechanism can be supplied if desired for use in cutting bars, tubes or angle stock.

Load Cushions on Coupling Interchangeable

Lovejoy Tool Works, West Lake street, Chicago, has introduced a flexible coupling with individual free-floating load cushions hung between jaws on removable studs. The couplings are available in shaft diameters from 3 to 10 inches. The cushion material can be either a long wearing brake-lining material, an oak-tanned belting leather, or a rubber-duck fabric.

In operation, one half of the cushions are idlers, except on reversing loads, and there always is a set of new cushions in the coupling. It is claimed this feature eliminates shutdowns as load cushions can be interchanged easily and quickly without tearing down the coupling.

Uses Color System

Leeds & Northrup Co., Philadelphia, has introduced a new system of numerals in colors to simplify reading of multiple-point instrument records. The numerals are printed in different colors including black, green, red, violet, yellow and blue, and each print-wheel carries a separate inking pad for each point to be recorded. It is claimed that the use of contrasting colors makes reading of records easy and avoids errors.

Designs Stair Tread

Blaw-Knox Co., Pittsburgh, has introduced a stair tread which has a nosing made from rolled diamond checkered plate. A twisted crossbar feature of the grating provides more safety, as the rough surface of the twisted bar affords a grip for shoe soles.

Air Recirculated In Tempering Furnace

Despatch Oven Co., 622 Ninth Street, S. E., Minneapolis, has introduced a convected air tempering furnace which is heated by gas. The furnace has high capacity electric motor driven rotary fan units arranged at the top of the works chamber. These fans propel the heated air downward upon

Electric motor driven rotary fan units in the top of the chamber recirculate the air

the parts to be processed with pressure and great velocity. The air enters specially arranged recirculating and ventilating ducts at the bottom of the unit. Through the use of special baffles, air travel through the furnace is positive, and it is claimed uniformly treated products are assured. Up to four changes per minute are obtained in the working chamber of the furnace.

It is also claimed that the use of gas, together with the combined air circulating and recirculating arrangement, provide a considerable saving in the cost of operation. Up to 80 per cent of the air may be recirculated.

The thirty-sixth annual convention of the International Acetylene association will be held at the Hotel Cleveland, Cleveland, Nov. 12 to 15, according to a recent announcement of H. F. Reinhard, secretary of the association.

GLOBE SHOT

H.C. CHILLED GLOBE SHOT
Reg. U. S. Pat. Off.

Cuts Cleaning Costs!

Every saving counts now when costs must be cut to meet conditions. Why let the other fellow with lower cleaning costs have the advantage over you in figuring selling prices?

One ton of Globe shot in most cases will convince you that shot-blasting is the low-cost way to clean castings, whether grey iron, malleable or steel.

Write us for samples and data that *shows* you why Globe Shot will save you money.

CONSERVED STEEL GLOBE GRIT
Reg. U. S. Pat. Off.

The
GLOBE STEEL ABRASIVE CO.
Dept. F
Mansfield, Ohio

CONVENTION HEADQUARTERS

The Largest Hotel in the British Empire

Your trip to Canada is not complete without a visit to the Royal York, Toronto's magnificent modern hotel.

Here you may enjoy a quiet night's sleep in comfort and luxury. Here you select your choice from menus that provide the best the world affords. Here you may dance to the newest music or relax after the business day with a well stocked library at your service.

1100 Bedrooms, each with private bath and shower.

Single Rooms
$4.00 per day

Double Rooms
$7.00 per day

European plan

THE ROYAL YORK
TORONTO
A Canadian Pacific Hotel

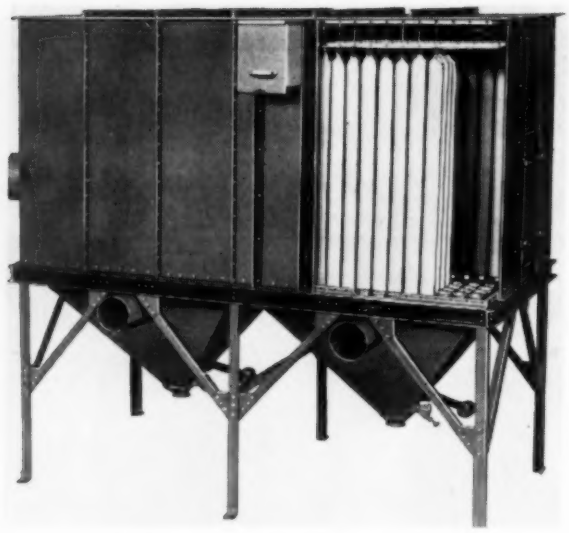
REPRESENTING A TOTAL CAPACITY *of*

30 MILLION 630 THOUSAND TONS *of* PIG IRON ANNUALLY

H W
REG. U.S. PAT. OFF.

Hickman, Williams & Co.
(INCORPORATED)

CHICAGO PHILADELPHIA CINCINNATI CLEVELAND
ST. LOUIS DETROIT NEW YORK PITTSBURGH MINNEAPOLIS



The bag shaker produces a quick, snapping action through an electric motor

Dust Filter Uses Tubular Bag Type Units

Ruemelin Mfg. Co., 3860 North Palmer street, Milwaukee, is marketing a tubular bag type dust filter. In this unit, a special filter cloth is formed into a tube having a closed top and open bottom. All seams are folded double and sewed for strength and to protect against dust leakage. The top of the bag is provided with a hanger rod for suspension from the ceiling of the filter housing. The bottom of the bag is telescoped over shouldered collars and provided with felt seal and special wire clamps to insure against loosening and dust leakage. A steel ring sewed near the top of the bags maintains its circular shape, thereby causing thorough dust removal when the bags are shaken.

The bag shaker produces a quick snapping action through an electric motor and cut gear transmission to the shaker rods. Filter tubes are enclosed in a heavy gage steel housing rigidly re-enforced to withstand high vacuum. Dust hoppers are constructed of heavy gage steel plates and are sloped at the proper angle for discharging the precipitated dust. When desired, a suitable fan and motor housing can be supplied as an extension to the filter housing. A settling or pre-separation chamber can be supplied for any capacity filter.

Gear Reducer Has Motor Attached

A new line of motorized helical gear reducers has been announced by the Link-Belt Co., 910 South Michigan avenue, Chicago. A standard round-frame motor is secured firmly to the side of the reducer housing by an adapter casting which supports the motor shaft in over-size antifriction bearings close to the pinion. The complete motor, with adapter and motor pinion may be removed as a unit for inspection or maintenance without disturbing the alignment of the motor or of the gears remaining in the reducer housing.

All gears are of the helical type with teeth cut from heat treated alloy steel. The low speed shaft and its bearings are designed to carry overhung loads. A well-braced and ribbed gray iron housing provides a rigid mounting for the bearings, shafts and motor, as well as constituting a liberal sized reservoir for automatic lubrication of the gears and bearings.

The new motorized reducers may be mounted on floor, ceiling or wall, and are available in double reduction for ½ to 75 horsepower, in ratios up to 38 ½ to 1, and in triple reduction up to 30 horsepower, in ratios up to 292 to 1.

Vibratory Screen Has Motion Adjustment

Paterson Engineering Co., 420 Samson street, Philadelphia, has developed a vibratory screen in which the vibration may be adjusted to suit the material. The screen has the vibrator element supported in an inverted U-shaped metal frame and the sieve basket fits into a quick-set clamp at the bottom of the frame.

Vibratory motion is obtained through a motor-driven unbalanced weight, and is controlled by adjusting the position of the weight. The motor is sealed in a dust-proof hood and operates on any lighting circuit. A special method is provided to fasten the sieve cloth. Flat or cone-shaped sieve disks or metal screen cloth of the proper mesh are provided with a steel edging. The disk is laid in the basket and a sieve lock ring inserted on top. A few turns of a single-wing-nut seats the disk. The screen is portable.

Vibratory motion is obtained through a motor driven, unbalanced weight

X-Ray Inspects Castings on Conveyor

Adrian X-Ray Mfg. Co., 3535 North Palmer street, Milwaukee, has introduced a new continuous type X-ray. As products pass through the machine on a conveyor belt, the operator looks through an eye piece to obtain an interior view of each unit. The machine also has a radiograph attachment for making X-ray photographs in case these are desired of any specific product.

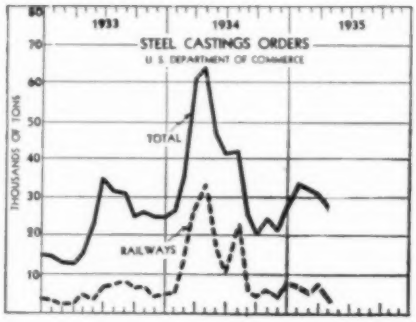
The machine has a radiograph attachment for making photographs

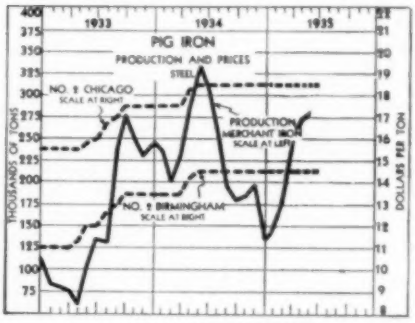
The unit has a voltage capacity of 150,000 volts, but requires only a small amount of current. Special tubes have been constructed and a cooling arrangement devised which permits continuous operation of the machine during working hours.

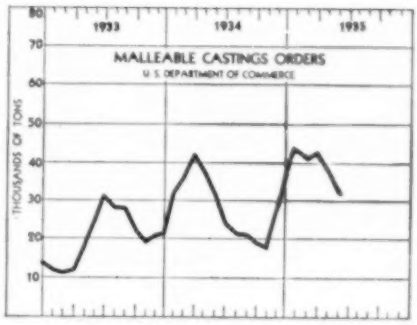
Circuit Breaker Controls Variables

Taylor Instrument Companies, Rochester, N. Y., has introduced a reset controller which controls temperature, pressure, rate of flow or liquid level in a predetermined relation to some other temperature, pressure, rate of flow or liquid level. It can be used in applications where a fixed differential must be maintained between two variables, one of which is under control, or where it is desired to change the control points of a process in accordance with a predetermined ratio to a secondary process or condition.

ADVERTISING PAGES REMOVED







Foundry Activities

Reflect Industrial Trends

MAGNUS CO. INC., 806 North Main street, Los Angeles, recently has awarded a contract to the Austin Co. of California for the erection of a new foundry building at an estimated cost of $90,000. It will be a one-story, steel frame building containing 50,500 square feet of space.

* * *

Northwest Stove Works, 2345 Southeast Gladstone street, Portland, Ore., recently sustained damage to its foundry due to fire.

* * *

Kalamazoo Stove Co., Kalamazoo, Mich., is having plans prepared for an addition to its plant by Leroy & Newlander, architects.

* * *

Chevrolet Motor Co., 3044 West Grand boulevard, Detroit, is planning extensive expansion of it Saginaw and Bay City parts plants.

* * *

Lombard Iron Works, East Spartanburg, S. C., recently has been closed. Plans for the future have not been disclosed.

* * *

Dearborn Brass Co., Cedar Rapids, Iowa, manufacturers of plumbing specialties, is planning to rebuild its factory which recently was damaged by fire.

* * *

Standard Sanitary & Mfg. Co., 2801 Preble avenue, North Pittsburgh, will reopen shortly, after being idle for 3 years. Operations are expected to begin about Aug. 1.

* * *

H. J. Wandtke Pattern Works has removed of its office and plant from 518 West Eleventh street, Anderson, Ind., to West Fourteenth street and Big Four Railroad, Anderson. A change in name has also been announced, the company hereafter to be known as Central Pattern & Foundry Co., and will manufacture wood and metal patterns and aluminum alloy castings.

* * *

Florence Stove Co., Gardner, Mass., is planning to install power equipment in the two new additions of its plant at an approximate cost of $70,000.

* * *

Carondelet Foundry Co., St. Louis,

RAW MATERIAL PRICES
July 1, 1935

Iron	
No. 2 foundry, Valley	$18.50
No. 2 Southern, Birmingham	14.50
No. 2 foundry, Chicago	18.50
No. 2 foundry, Buffalo	18.50
Basic, Buffalo	17.50
Basic, Valley	18.00
Malleable, Chicago	18.50
Malleable, Buffalo	19.00
Charcoal iron, furnace	21.00
Coke	
Connellsville beehive premium	$5.10 to $ 5.35
Wise county beehive coke	4.30 to 5.00
Detroit by-product coke	8.50
Scrap	
Heavy melting steel, Valley	$11.50 to $12.00
Heavy melting steel, Pitts.	11.75 to 12.25
Heavy melting steel, Chicago	9.75 to 10.25
Stove plate, Buffalo	9.25 to 9.75
Stove plate, Chicago	6.00 to 6.50
No. 1 cast, New York	7.00 to 7.25
No. 1 cast, mchy., Chicago	9.00 to 9.50
No. 1 cast, Pittsburgh	13.50 to 14.00
No. 1 cast, Philadelphia	11.00 to 12.00
No. 1 cast, Birmingham	9.00 to 9.50
Car wheels, iron, Pittsburgh	12.00 to 12.25
Car wheels, iron, Chicago	10.00 to 10.50
Railroad malleable, Chicago	13.00 to 13.50
Malleable, Buffalo	13.00 to 13.50
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	7.25
Straits tin	51.75
Aluminum, 99 per cent	19.00 to 21.00
Aluminum, No. 12 (Secondary)	16.75 to 17.25
Lead, New York	4.00
Antimony, New York	12.75
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.30

is installing a 3000-pound rocking type furnace for high-strength alloy castings, increasing capacity eight tons daily.

* * *

Western Alloyed Steel Castings Co., St. Paul, Minn., has been incorporated to manufacture steel castings by Edwin F. Jungar, Charles C. Hess and William C. Green.

* * *

Lufkin Foundry & Machine Co., Lufkin, Tex., has untertaken a $50,000 expansion project to meet increased production requirements. Mosher Steel Co., Houston, was awarded the contract.

* * *

Rock City Foundry, Wabash, Ind., recently has been organized by R. M. Stauffer, L. Habitch and E. F. Mattern. The company will lease the Wabash foundry from the North Manchester Foundry Co., for the manufacture of castings.

* * *

Brown Stove Works, Cleveland, Tenn., has been incorporated with $200,000 capital by Grover C. Brown and J. M. Carl. A tract of 15 acres has been acquired for erection of a plant which will include foundry and pattern shop.

* * *

Reconstruction Finance Corp. has extended loans to the following firms during the month of May: Acme Foundry Corp., Cleveland, $20,000; American Casting Co., Birmingham, Ala., $100,000; General Alloys Co., Boston, $60,000.

* * *

Gilbert Brass Foundry Co., St. Louis, Mo. has acquired a factory on Farlin avenue at a cost of $25,000.

Additional space to accomodate expanding business is the reason for the acquisition, according to Charles F. Gilbert, president.

* * *

Foundry of the Whiting Co., Harvey, Ill., has reopened after being idle for some time. At present, the foundry is making gray iron, brass and nonferrous and lead castings, and expects shortly to cast steel in the bessemer converter.

* * *

Index of foundry equipment orders for May, according to a report of the Foundry Equipment Manufacturers' association, Cleveland, was 100.7 as compared with 113.0 for April and 66.5 in May, 1934. Index of shipments was 67.0 as compared with 69.7 in April and 75.6 in May, 1934.

* * *

American Radiator Co., Buffalo, is remodeling and adding new construction at the former Equipment plant in Buffalo. The program includes the installation of modern molding equipment for the manufacture of cast iron radiators, which probably will require the balance of the year for completion.

* * *

Output of gray iron castings in the Philadelphia district for May was 10.2 per cent more than in April, according to reports of the Industrial Research department, University of Pennsylvania. Output of malleable iron castings during May was 11.6 per cent less than the previous month and 3.7 per cent less than in the same period last year. Activities of steel foundries remained about the same as last month, showing a slight increase in production of castings for jobbing work.

* * *

Youngstown Alloy Casting Corp., Youngstown, O., which will operate one of the smallest commercial open hearth furnaces, recently has been incorporated by J. Trantin Jr., and George D. Trantin. The company has leased part of the Mahoning Foundry Co. plant, 103 East Indianola avenue, and is building a one-ton acid open-hearth furnace and a 100-pound electric furnace. The 100 pound furnace will be used to carry on experiments, while the other furnace will manufacture special alloy castings for the mill industry and seamless tubing industry.

* * *

Foundry operations in the Chicago district during June declined for the second consecutive month, although average schedules remained above the rate a year ago. Reduced automotive requirements contributed largely to last month's decrease. Farm implement manufacturers continue active operations, tractor plants being particularly busy and anticipating heavy output into September. June pig iron shipments were off about 10 per cent from May. Foundry coke deliveries increased, but the gain was due partly to buying in anticipation of a coke shortage resulting from the threatened coal strike.

New Trade Publications

DISKS — Norton Co., Worcester, Mass., recently has published an interesting and exceptionally well-illustrated folder on its line of disks for various kinds of surfacing. These include vitrified, bakelite, silicate and shellac.

DIE CASTINGS—Chicago Die Casting Mfg. Co., 2512 West Monroe street, Chicago, recently has published a bulletin giving specifications on a number of its die cast products.

TOOLS—A catalog of portable electric tools, including grinders, recently has been published by the Black & Decker Co., Towson, Md. Celebration of the twenty-fifth anniversary of the company is featured throughout the book.

NAILS—Information on its line of nails, including those for foundry use, is contained in a folder recently published by the Angell Nail & Chaplet Co., 4580 East Seventy-first street, Cleveland.

HAND TRUCKS—Fairbanks Co., 393 Lafayette street, New York, has published a catalog on its line of hand trucks. Illustrations show designs for various purposes, and data on dimensions and weight also are given.

FIRST-AID — Burroughs Wellcome & Co., 9 East Forty-first street, New York, recently has prepared a catalog on its line of first-aid products for industry. Numerous first-aid kits are illustrated, with the contents listed.

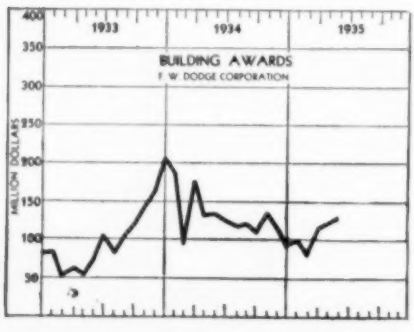
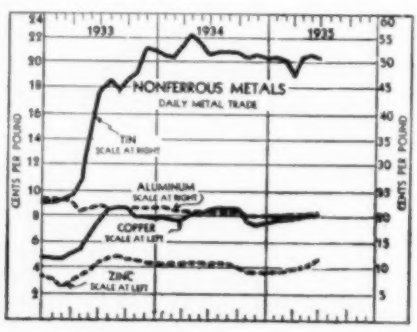
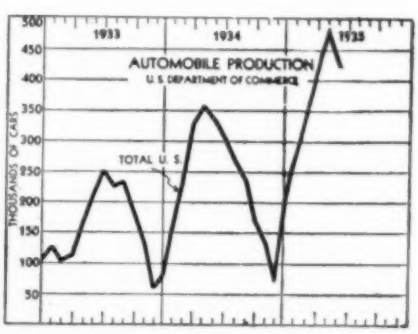
PINS AND BUSHINGS — Federal Screw Works, Detroit, Mich., has published a folder on its line of Cannon interchangeable pins and bushings. It is pointed out that the use of these pins increases the life of the flask and, by reducing scrap, cuts foundry losses.

POLISHING—Abrasive Co., Philadelphia, has published a folder on its Borolon polishing grain. It is pointed out that the capillarity or high glue absorption of the grain, together with its roughened surface, gives a strong bond with the glue so that the grain holds fast to the polishing wheel.

LADLES—New features of design in its line of geared ladles, including forced lubrication and automatic safety brake are presented in a recent bulletin of the Whiting Corp., Harvey, Ill. The new ladle retains the cut helical-worm gearing and ball bearings provided in earlier designs.

CENTRIFUGAL CLEANING—Pangborn Corp., Hagerstown, Md., has published a bulletin on its centrifugal blast cleaning machine. Information concerning centrifugal cleaning is presented and 10 features of the company's blast cleaning equipment are discussed.

FURNACE LININGS—McLeod & Henry Co., Troy, N. Y., has prepared its catalog 235 dealing with furnace linings and arches, including information on design, installation and service advantages for modern boiler furnaces. The publication is well-illustrated with drawings showing methods of application.

SPECTROGRAPHS—Bausch & Lomb Optical Co., Rochester, N. Y., has published a booklet entitled "Something New in Spectrographs" in which a small Littrow spectrograph is described. It is pointed out that this development provides an instrument for industry and education, where moderately high dispersion, but no great resolving power is necessary. The company also has published a bulletin on a new density comparator.

REFRACTORY INSULATING BRICK—Charles Taylor Sons Co., Cincinnati, has published a boooklet discussing advantages claimed for its refractory insulating brick. Results of tests and other engineering data are given, and characteristics of the material are presented. It is pointed out that among other uses, the brick may be used for electric furnaces, annealing furnaces, enameling furnaces, heat treating furnaces, core ovens and baking ovens.